

**WORKING COPY**

**SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS  
ENVIRONMENTAL PROGRAMS WORLDWIDE  
INSTALLATION-SPECIFIC WORK PLAN**

**FAIRCHILD AIR FORCE BASE  
SPOKANE, WASHINGTON**

**Prepared for:**

**Air Force Civil Engineer Center  
Joint Base San Antonio – Lackland, Texas**



**Prepared by:**



**Amec Foster Wheeler Environment & Infrastructure, Inc.**

**Contract FA8903-16-D-0027  
Task Order 0004**

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## APPENDICES

Appendix A	Installation-Specific Health and Safety Plan
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## ACRONYMS

1		
2	AFB	Air Force Base
3	AFCEC	Air Force Civil Engineer Center
4	AFFF	aqueous film forming foam
5	Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
6	amsl	above mean sea level
7	ASTM	ASTM International
8		
9	bgs	below ground surface
10		
11	CE	Civil Engineer
12	CES	Civil Engineering Squadron
13	CFR	Code of Federal Regulations
14	CSM	conceptual site model
15	CZR	Environmental Restoration Division
16		
17	DO	dissolved oxygen
18	DOT	Department of Transportation
19	DPT	direct push technology
20	DQO	data quality objectives
21	DRO	diesel range organics
22		
23	FAA	Federal Aviation Administration
24	ft	feet
25	FTA	fire training area
26		
27	GPS	Global Positioning System
28	GRO	gasoline range organics
29		
30	HA	Health Advisory
31	HGL	Hydrogeologic, Inc.
32	HSP	Health and Safety Plan
33		
34	IDW	investigation-derived waste
35	ISWP	Installation-Specific Work Plan
36		
37	µg/kg	micrograms per kilogram
38	µg/L	micrograms per liter
39	mg/kg	milligrams per kilogram
40	mg/kg/day	milligrams per kilogram per day
41		
42	ORP	oxidation reduction potential
43	OWS	oil/water separator
44		
45	PA	Preliminary Assessment

1	PFBS	perfluorobutane sulfonate
2	PFC	perfluorinated compound
3	PFOA	perfluorooctanoic acid
4	PFOS	perfluorooctane sulfonate
5	pH	potential of hydrogen
6	PPE	personal protective equipment
7	PVC	polyvinyl chloride
8		
9	QAPP	Quality Assurance Project Plan
10	QC	quality control
11	QPP	Quality Program Plan
12		
13	RPM	Remedial Program Manager
14	RSL	Regional Screening Level
15		
16	SI	Site Inspection
17	SOP	Standard Operating Procedure
18	SVOC	semivolatile organic compounds
19		
20	UFP	Uniform Federal Policy
21	USAF	United States Air Force
22	USEPA	United States Environmental Protection Agency
23		
24	VOC	volatile organic compounds
25		

## 1.0 PROJECT OVERVIEW

This Installation-Specific Work Plan (ISWP) has been prepared under Contract No. FA8903-16-D-0027, Task Order 0004 between Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) and the Air Force Civil Engineer Center (AFCEC), and is provided as an addendum to the General Quality Program Plan (QPP) (Amec Foster Wheeler, 2016). This ISWP describes Site Inspection (SI) activities to be conducted at aqueous film forming foam (AFFF) areas located at Fairchild Air Force Base (AFB) to determine if a release of perfluorinated compounds (PFCs) may have occurred. The AFFF areas proposed for inspection under this ISWP were identified during Preliminary Assessment (PA) research activities (CH2M HILL, 2015) and during an on-site scoping meeting as locations where PFCs may have been released to the environment.

This ISWP and the QPP have been prepared to: (1) clearly identify the SI objectives and data quality objectives (DQOs) for this project; (2) ensure that field investigations and survey protocols are documented and reviewed in a consistent manner; and (3) describe the means and methods necessary to achieve the SI objectives and DQOs and to provide data that are scientifically valid and legally defensible. Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) worksheets are provided in the following sections to accompany the General QPP. The Installation-Specific Health and Safety Plan (HSP) is provided in **Appendix A** of this ISWP.

### 1.1 PERFLUORINATED COMPOUNDS OVERVIEW

PFCs are a class of synthetic organofluorine compounds that possess a chemical structure that gives them unique properties, including thermal stability and the ability to repel both water and oil. These chemical properties make them useful components in a wide variety of consumer and industrial products, including non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards for fire extinguishing agents (Department of Defense Military Specification MIL-F-24385F [SH], Amendment 1, 5 August 1984). The United States Air Force (USAF) began purchasing and using AFFF containing PFCs (perfluorooctanesulfonic acid [PFOS] and/or perfluorooctanoic acid [PFOA]) for extinguishing petroleum fires and firefighting training activities in 1970, as confirmed by the following federal government documents:

- Military Specification for AFFF (MIL-F-24385), formally issued in 1969;
- General Accounting Office determination on sole source award protest to provide AFFF to the Navy in December 1969; and
- A History of USAF Fire Protection Training at Chanute Air Force Base, 1964-1976 (Coates, 1977).

AFFF was primarily used on USAF installations at fire training areas (FTAs), but may have also been used, stored, or released from hangar fire suppression systems, at firefighting equipment testing and maintenance areas, and during emergency response actions for fuel spills and aircraft mishaps. Although manufacturers have reformulated AFFF to eliminate PFOS, the United States Environmental Protection

Agency (USEPA) continues to permit the use of PFOS-based AFFF and the USAF maintains a significant inventory of PFOS-based AFFF. The USAF is actively replacing their current supply of AFFF with a PFOS-free formulation that may be less persistent and bioaccumulative in the environment.

The USEPA Office of Water issued lifetime drinking water Health Advisory (HA) values for PFOS and PFOA in May 2016 to protect humans from potential risk of exposure to these chemicals through drinking water; the 2016 HA values replace 2009 Provisional Health Advisory values. The HA values for PFOS and PFOA are 0.07 micrograms per liter ( $\mu\text{g/L}$ ) for each constituent; however, when these two chemicals co-occur in a drinking water source, a conservative and health-protective approach is recommended that compares the sum of the concentrations (PFOS + PFOA) to the HA value (0.07  $\mu\text{g/L}$ ). HA values identify the concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over specific exposure durations (e.g., one day, ten days, a lifetime). They serve as informal technical guidance to assist federal, state, and local officials, and managers of public or community water systems in protecting public health when emergency spills or other contamination situations occur. A HA document provides information on the environmental properties, health effects, analytical methodology, and treatment technologies for removing drinking water contaminants. HA values are not to be construed as legally enforceable federal standards and are subject to change as new information becomes available (USEPA, 2016a and 2016b).

The USEPA has not currently published Regional Screening Levels (RSLs) for PFOS or PFOA for soil or sediment; however, for this project, a screening level of 1,260 micrograms per kilogram ( $\mu\text{g/kg}$ ) for soil and sediment was calculated using the USEPA RSL calculator ([https://epaprgs.ornl.gov/cgi-bin/chemicals/cls\\_search](https://epaprgs.ornl.gov/cgi-bin/chemicals/cls_search)). The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 milligrams per kilogram ( $\text{mg/kg}$ ) per day ( $\text{mg/kg/day}$ ) derived by USEPA in their Drinking Water Health Advisories for both PFOS and PFOA (USEPA, 2016a and 2016b).

## **1.2 INSTALLATION MISSION AND HISTORY**

Fairchild AFB is located in northeastern Washington, approximately 12 miles west of Spokane, in Spokane County, Washington, and encompasses approximately 4,300 acres (**Figure 1**). The installation is comprised of one major runway supported by numerous taxiways and support facilities, a hospital, housing units, and an elementary school.

The installation was established in 1942 and has served numerous missions ranging from a repair depot for damaged aircraft returning from World War II, to its current primary mission as the largest air-refueling wing in the USAF (USAF, 2016). The installation was originally constructed as a World War II repair and supply depot within the Cascade Mountains, 300 miles from the ocean, where it would be safe from Japanese attack. The installation was transferred to the Strategic Air Command in 1947 and became home of the 92nd Bombardment Wing. The 92nd Bomb Wing was re-designated the 92nd Air Refueling Wing in 1994, and the installation was transferred to the Air Mobility Command. Since then it provides air refueling and wing supporting contingency operations around the world and today represents the backbone of the USAF west coast tanker fleet.

### 1.3 PRELIMINARY ASSESSMENT

HydroGeoLogic, Inc. (HGL) and subcontractor CH2M HILL (the HGL team) was contracted by AFCEC to prepare a PA of FTA and non-FTA sites at Fairchild AFB to determine locations of potential environmental release of PFCs from AFFF storage or usage areas (CH2M HILL, 2015). Sixteen potential AFFF release areas were identified during the PA research, with the following three potential AFFF release areas recommended for SI (**Figure 2**):

- 1) FT004 (FT01): The former FTA was used after 1970 through approximately 1991 during which an estimated 125 gallons or more of AFFF were used during each training exercise. After each exercise, the remaining water, fuel, and foam were drained into an oil/water separator (OWS) which discharged into a low area east of the training location.
- 2) Aircraft Crash Location SS008 (PS-4/9): An unknown quantity of AFFF was used to extinguish a JP-4 fire in March 1987 that resulted from the crash of a KC-135 aircraft in a grassy field near Buildings 2005 and 2007.
- 3) B-52 Crash Location 1994: An unknown quantity of AFFF was released onto a grassy field approximately 900 feet southeast of the control tower while extinguishing a JP-4 fire following the crash of a B-52 in 1994.

The following two additional areas are also recommended for investigation based on data obtained during the installation scoping visit conducted 27 September 2016 (see **Figure 2** and **QAPP Worksheet #9**):

- 1) Fire Station 1 (Building 3): Calibration tests using AFFF occurred on the paved area directly south of the fire engine garage. The paved area drains through a gap in the curb into a grassy area between the pavement and a wall that divides the fire station from the airfield.
- 2) Calibration Area: AFFF was sprayed onto an old taxiway where it could flow south to an unpaved area.

### 1.4 SITE INSPECTION OBJECTIVES AND SCOPE

The primary objectives of this study are to:

- Determine if a confirmed release of PFOS and PFOA has occurred,
- Determine if PFOS and PFOA are present in groundwater or surface water at concentrations exceeding the USEPA lifetime HA,
- Determine if PFOS and PFOA are present in soil or sediment at concentrations exceeding calculated RSLs, and
- Identify potential receptor pathways with immediate impact to human health.

As a result of the initial SI, follow-on objectives may include the following:

- Perform follow-up sampling of off-base public/private drinking water wells to identify and verify where PFCs are present in drinking water at concentrations above USEPA HA values and/or state-specific standards and evaluate potential exposure pathways with immediate threats to human health.

In accordance with Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (USAF, 2012) and USEPA lifetime drinking water HAs for PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b), a release will be considered confirmed if exceedances of the following concentrations are identified:

#### **PFOS**

- 0.07 µg/L in groundwater/surface water that is used as or contributes to a drinking water source (combined with PFOA value).
- 1,260 µg/kg in soil (calculated, in the absence of regional screening-level values).
- 1,260 µg/kg in sediment (calculated in the absence of regional screening-level values).

#### **PFOA**

- 0.07 µg/L in groundwater/surface water that is used as or contributes to a drinking water source (combined with PFOS value).
- 1,260 µg/kg in soil (calculated, in the absence of regional screening-level values).
- 1,260 µg/kg in sediment (calculated in the absence of regional screening-level values).

While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the SI, USEPA has also derived RSL values for perfluorobutane sulfonate (PFBS) for which there is a Tier 2 toxicity value (Provisional Peer Review Toxicity Value). The USAF will also consider a release to be confirmed if exceedances of the following concentrations are identified:

#### **PFBS**

- 380 µg/L in groundwater/surface water
- 1,600,000 µg/kg in soil and sediment.

**Table 1** presents screening level values for comparing the analytical results for each of the compounds.

**Table 1. Regulatory Screening Values**

Parameter	Chemical Abstract Number	EPA Regional Screening Level Table (May 2016) <sup>a</sup>			Calculated RSL for Soils and Sediments <sup>b</sup> (µg/kg)	USEPA Health Advisory for Drinking Water (Surface Water or Groundwater) (µg/L) <sup>c</sup>
		Residential Soil (µg/kg)	Industrial Soil (µg/kg)	Tap Water (µg/L)		
PFBS	375-73-5	1.6E+6	2.3E+7	380	NL	NL
PFOA	335-67-1	NL	NL	NL	1,260	0.07 <sup>d</sup>
PFOS	1763-23-1	NL	NL	NL	1,260	

**Notes:**

a USEPA Regional Screening Levels (May 2016) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016>]

b Screening levels calculated using the USEPA Regional Screening Level calculator [[https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl\\_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)]

c USEPA, May 2016a, "Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)" and USEPA, May 2016b, "Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)."

d When both PFOA and PFOS are present, the combined concentrations of PFOA and PFOS should be compared with the 0.07 µg/L HA level.

µg/kg = micrograms per kilogram

µg/L = micrograms per liter

USEPA = Environmental Protection Agency

NL = not listed

RSL = risk-based screening level

Follow-on objectives and sampling design and rationale, if applicable, will be defined and described in addendums to this ISWP. It is anticipated that follow-up sampling of known off-base public/private drinking water wells located east of the base may be needed to identify and verify whether PFCs are present in drinking water at concentrations above USEPA HA values. However, this follow-up off-base sampling will only be conducted in the event PFCs are detected above the USEPA HA values at the eastern base boundary (at FT004 [FT01]).

The proposed sampling approach for Fairchild AFB is detailed in QAPP Worksheets #9, #10, #11, #13, #14/16, #17, #18, and #20 of this ISWP. The QAPP consists of 37 prescriptive worksheets to document aspects of the environmental investigation process of the SI and to guide the fieldwork. Table 2 presents the required elements of the QAPP, the worksheets where these elements can be found, and the document containing the worksheet.

**Table 2. List of UFP-QAPP Worksheets.**

Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Title and Approval Page	1 and 2	Identifies the principal points of contact for all organizations having decision-making authority in the project and documents their commitment to implement the QAPP.	X	

Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Project Organization and QAPP Distribution	3 and 5	Identifies key project personnel, lines of authority, and lines of communication among the lead agency, prime contractor, subcontractors, and regulatory agencies.	X	
Personnel Qualifications and Sign-Off Sheet	4, 7, and 8	Identifies key project personnel for each organization performing tasks defined in the QAPP and documents their commitment to implementing the QAPP.	X	
Communication Pathways and Procedures	6	Documents specific issues (communication drivers) that will trigger the need to communicate with other project personnel or stakeholders.	X	
Project Planning Session Summary	9	Provides a record of the notes taken during the site scoping visit.		X
Conceptual Site Model (CSM)	10	Presents the installation-wide CSM with information on each AFFF release area.		X
Project/Data Quality Objectives (DQOs)	11	Documents the DQOs, the environmental decisions that need to be made, and the level of data quality needed to ensure that those decisions are based on sound scientific data using USEPA's seven-step data quality objective process.	X	X
Measurement Performance Criteria	12	Documents the quantitative measurement performance criteria in terms of precision, bias, and sensitivity for field and laboratory measurements and is used to guide the selection of appropriate measurement techniques and analytical methods.	X	
Secondary Data Uses and Limitations	13	Identifies sources of secondary data and summarizes information relevant to their uses for the current project.		X
Project Tasks and Schedule	14 and 16	Presents the proposed installation-specific schedule for the SI activities, specific tasks, group responsible for their execution, and planned start and end dates.		X
Project Action Limits and Laboratory- Specific Detection/ Quantitation Limits	15	This worksheet is completed for each matrix, analyte, and analytical method. The purpose is to make sure the selected analytical laboratory and method can provide accurate data at the project action limit.	X	
Sampling Design and Rationale	17	Describes the sampling design and the basis for selection of each AFFF release area for SI.		X



Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Sampling Locations and Methods	18	Provides a completeness check for field personnel and auditors for all samples anticipated for collection during the SI. It will facilitate checks to ensure all planned samples have been collected and appropriate methods have been used. The worksheet lists each individual sample that is planned to be collected, including field quality control (QC) samples.		X
Sample Containers, Preservation, and Hold Times	19 and 30	Worksheets serve as a reference guide for field personnel. They are also an aid to completing the chain of custody forms and shipping documents.	X	
Field Quality Control	20	Provides a summary of the types of samples to be collected and analyzed for the project to show the relationship between the number of field samples and associated QC samples.		X
Field Standard Operating Procedures (SOPs)	21	Documents the specific field procedures being implemented. The QPP contains detailed descriptions of procedures for all field activities, including sample collection; sample preservation; equipment cleaning and decontamination; equipment testing, maintenance, and inspection; and sample handling and custody.	X	
Field Equipment Calibration, Maintenance, Testing and Inspection	22	Documents procedures for calibrating, maintaining, testing, and/or inspecting all field equipment.	X	
Analytical SOPs	23	Documents information about the specific sample preparation and analytical procedures to be used.	X	
Analytical Instrument Calibration	24	Documents the laboratory calibration procedures and is completed for all analytical instruments referencing the project laboratory quality manual.	X	
Analytical Instrument and Equipment Maintenance, Testing, and Inspection	25	Documents the procedures for maintaining, testing, and inspecting laboratory analytical equipment and was completed referencing the project laboratory quality manual.	X	
Sample Handling, Custody, and Disposal	26 and 27	Documents responsibilities for maintaining custody of samples from sample collection through disposal.	X	
Analytical Quality Control and Corrective Action	28	Ensures that the selected analytical methods are capable of meeting the project-specific measurement performance criteria.	X	

Required Element	UFP-QAPP Worksheet Number	Contents of Worksheet(s)	Presented in QPP	Presented in ISWP
Project Documents and Records	29	Records information for all documents and records that will be generated for the project. It describes how information will be collected, verified, and stored. The purpose is to support data completeness, data integrity, and ease of retrieval.	X	
Assessments and Corrective Action	31, 32, and 33	Documents responsibilities for conducting project assessments, responding to assessment findings, and implementing corrective action.	X	
Data Verification and Validation Inputs	34	Lists the inputs that will be used during data verification and validation.	X	
Data Verification Procedures	35	Documents procedures that will be used to verify project data.	X	
Data Validation Procedures	36	Documents procedures that will be used to validate project data.	X	
Data Usability Assessment	37	Documents procedures that will be used to perform the data usability assessment.	X	

- 1 **Notes:**
- 2 CSM = Conceptual Site Model
- 3 DQOs = data quality objectives
- 4 QAPP = Quality Assurance Project Plan
- 5 SOP = Standard Operating Procedure
- 6 UFP = Uniform Federal Policy
- 7 USEPA = United States Environmental Protection Agency

## 2.0 REFERENCES

- 1
- 2 Amec Foster Wheeler, 2016. *Working Copy (Revision 1) Site Inspection of Film Forming Foam (AFFF)*
- 3 *Release Areas Quality Program Plan*. November.
- 4 Coates, C.Y. 1977. *A History of USAF Fire Protection Training at Chanute Air Force Base, 1964-1976*.
- 5 Chanute Technical Training Center, Chanute AFB, Illinois. February.
- 6 CH2M HILL, 2009, *Final Work Plan for Triad-Based Contaminant Source Reduction at the Craig Road*
- 7 *Landfill- Fairchild AFB, Washington*. May.
- 8 CH2M HILL, 2015, *Final Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force*
- 9 *Base, Spokane, Washington*. June.
- 10 United States Air Force (USAF), 2016. *Fairchild Air Force Base: A Brief History* at
- 11 [http://www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-](http://www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-brief-history)
- 12 [brief-history](http://www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-brief-history), published 15 March.
- 13 United States Environmental Protection Agency (USEPA), 2012. *Uniform Federal Policy for Quality*
- 14 *Assurance Project Plans Workbook*. March.
- 15 USEPA, 2016a. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*. May.
- 16 USEPA, 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)*. May.



**QAPP WORKSHEET #9: PROJECT PLANNING SESSION SUMMARY**

**Date of planning session:** Installation Scoping Visit, conducted 27 September 2016.

**Location:** Fairchild AFB, Spokane, Washington

**Purpose:** The purpose of the Installation Scoping Visit was to (1) inspect potential AFFF release areas identified in the PA (CH2M HILL, 2015) to confirm if sampling is warranted during the Task Order 0004 investigation, (2) understand site logistics so that they could be incorporated into this ISWP, and (3) understand existing conditions so that they could be used to develop the investigation strategy and be factored into this ISWP and subcontractor scopes of work. The results of the Installation Scoping Visit were used to develop the sampling plan as detailed in **QAPP Worksheets #17 and #18**.

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**Attendees:**

- Marc Connally, Remedial Project Manager, AFCEC/CZOM
- Ed Zuelke, Restoration Program Manager, AFCEC/CZOM
- Kurt Lee (by teleconference), Remedial Program Manager, AFCEC/CZRW
- Bethany Flynn, Amec Foster Wheeler, Regional Lead
- Teresa Wilson, Amec Foster Wheeler, Field Team
- Kurt Lee, AFCEC CZR
- Monique Nixon, AFCEC/CZR
- Joel Espinoza, 92 Civil Engineering Squadron (CES)-Fairchild
- Paul DeRocker, 92 CES
- Michael Huggins, 92 AMDS
- Lauren Stingley, 92 CES
- Bill Shelton, 92 CES/CEIE
- Roberta LaPorte, 92 OSS/OSAA
- SSgt Ian Drain, 92 AMDS/SGPB
- Capt Marco Specoli, 92 ARW/JA

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**27 September 2016:** Amec Foster Wheeler personnel (Ms. Bethany Flynn and Ms. Teresa Wilson) arrived at Fairchild AFB and obtained one-day visitor passes. Ms. Flynn and Ms. Wilson met with Mr. Marc Connally, Remedial Project Manager (RPM), and Mr. Ed Zuelke, Environmental Restoration Program Manager, in a conference room with other attendees. The attendee list included personnel

1 knowledgeable about AFFF storage or releases, as well as base logistics leads who could provide  
2 information on investigation logistics such as waste storage and airfield restrictions.

3 Logistical details of the upcoming investigation work were discussed. Base access forms for Amec Foster  
4 Wheeler and all on-site subcontract personnel will be submitted to Mr. Marc Connally approximately 30  
5 days prior to the field date. No daily briefings with USAF personnel will be required. Work will not be  
6 conducted on weekends or holidays. For the proposed locations, including FT004 (FT01), no escort is  
7 needed and no other administrative requirements (e.g., airfield waiver) are applicable; an Amec Foster  
8 Wheeler lock will be used to access areas within the airfield perimeter.

9 Dig permits will be required for each location. Amec Foster Wheeler will stake locations a minimum of  
10 one month in advance of field work and will provide location information to Mr. Connally for dig permit  
11 approval. The dig permits will be kept on site during field work. No natural resources restrictions were  
12 identified that would restrict the scheduling or performance of the proposed field work. USAF personnel  
13 will take photographs when working within the airfield; however, no photographic restrictions apply to  
14 other investigation areas. Traffic plans are not required. Permanent monitoring wells will be installed  
15 using flush-mounted completions within the installation where appropriate.

16 The USAF will provide information on contamination in our proposed investigation areas for consideration  
17 in preparation of a site-specific HSP. Investigation-derived waste (IDW) will be staged in Building 2411  
18 pending characterization, profiling, and off-site disposal.

19 Weather was discussed as a factor in scheduling field work. Mr. Lee suggested that if field work does not  
20 occur before mid-November, delaying drilling work until March is acceptable to avoid heavy snow and  
21 frozen ground, which can inhibit subsurface utility line location and drilling operations.

22 No other releases or potential AFFF sources were identified by the meeting attendees, with the exception  
23 of potential releases to the sanitary sewer. Mr. Lee suggested the SI focus on documented releases and  
24 migration via known conceptual site model (CSM) elements. Mr. Zuelke agreed to check with the on-base  
25 fire department to confirm practices that may have led to releases to the sanitary or storm sewer systems.  
26 Mr. Zuelke also agreed to provide detailed locations from base records of the two crash sites that are part  
27 of the SI scope of work.

28 Amec Foster Wheeler and AFCEC personnel visited the following AFFF release areas to determine  
29 potential sampling locations and any utility/site conflicts with said locations:

30 **FT004 (FT01):** AFFF was reportedly used in this former unlined fire training burn pit from the early 1960s  
31 through 1991. Excess AFFF, water, and fuel remaining after each training exercise were discharged to an  
32 OWS, which in turn discharged to an open area east of the burn pit. Previous soil excavation was  
33 completed in this area. The former burn pit was located on a slightly elevated area, approximately 2 feet  
34 above the adjacent grade to the east and south. Several existing groundwater monitoring wells and wells  
35 related to an air sparge treatment system were observed southeast and east of the elevated area along  
36 the migration pathway of groundwater petroleum contamination. Monitoring well locations are

accessible, and survey coordinates will be used to identify the locations of the former burn pit and soil excavation. Two soil borings will be located within and adjacent to the former burn pit, and existing monitoring wells located near the source area and to the east near the base perimeter will be sampled.

**Calibration Area:** This site was not recommended for further investigation in the PA Report; however, based on a discussion with R. Woodworth, Assistant Fire Chief for Fairchild AFB, AFFF was periodically sprayed onto the roadway just south of the current FTA for equipment calibration. AFFF subsequently flowed off the roadway to the south onto unpaved areas. This site was not directly observed during the scoping visit; however, the SI scope has been developed to include two soil borings and one grab groundwater sample from locations immediately south of the roadway.

**Fire Station 1 (Building 3):** This site was not recommended for further investigation in the PA Report; however, based on a discussion with R. Woodworth, Assistant Fire Chief for Fairchild AFB, AFFF was sprayed onto the paved driveway area directly south of the fire engine garage for equipment calibration. The paved area drains through a gap in the curb into a grassy area between the pavement and a wall that divides the fire station from the airfield. Standing water was observed in an approximate 2- by 3-foot area immediately adjacent to the curb gap off the pavement. Anecdotally, AFFF has been released during calibration testing, and foaming recurred in the grassy area. The foam likely infiltrated in the grassy area and/or entered the storm drain system via a catch basin in the grassy area. The storm drain system discharges to a retention pond at the east side of the base. One sediment sample will be collected from the retention pond, and two soil borings will be advanced and sampled within the grassy area. One groundwater sample will be collected from the soil boring nearest the curb gap, and one groundwater sample will be collected from existing downgradient monitoring well MW\_399.

**Aircraft Crash Location SS008 (PS-4/9):** Based on detailed crash site information provided by Mr. Zuelke after the scoping visit, the crash occurred in the current grassy and parking lot areas near Buildings 2005 and 2007. Mr. Connally noted that several of the groundwater monitoring wells that appear on base drawings do not exist or are not locatable. As the exact location of AFFF application is unknown, three borings will be advanced and sampled along the axis of the crash area, and groundwater samples will be collected from three existing monitoring wells located within and downgradient of the crash site (MW-438, MW-265, and MMW-1023-1).

**B-52 Crash Location 1994:** The B-52 crash location was confirmed during the scoping visit to be in the southern portion of the area shown in the PA Report. Based on detailed crash site information provided by Mr. Zuelke after the scoping visit, the crash occurred within and south of the southern boundary shown in the PA Report, near an electrical substation compound. The crash area was reportedly limited due to the angle of the aircraft approach. Subsurface electrical lines run north/south through the crash site area and will need to be accurately located and clearly marked prior to investigation. An open drainage swale is located in the northeastern portion of the crash area. As the exact location of AFFF application is not known, three borings will be advanced and sampled along the axis of the crash area, and a grab groundwater samples will be collected from each boring.





# QAPP WORKSHEET #10: CONCEPTUAL SITE MODEL

An installation-wide Preliminary CSM with information regarding AFFF release areas is presented below. The preliminary CSM will be revised based upon the information and data collected during the site inspections, additional research, well surveys, and follow-on inspections, and presented as a narrative in the SI Report.

Table 3. Preliminary Conceptual Site Model.

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
<p><b>Installation Description/History:</b></p> <ul style="list-style-type: none"> <li>Years of operation: 1942 to present.</li> <li>Size: Approximately 4,300 acres.</li> <li>Location: Approximately 12 miles southwest of Spokane, Washington.</li> <li>Layout: Comprised of one major runway supported by numerous taxiways and support facilities, a hospital, housing units, and an elementary school.</li> <li>History: Constructed as a WWII repair and supply depot within the Cascade Mountains 300 miles from the ocean where it would be safe from Japanese attack. In 1947 the installation was transferred to the Strategic Air Command and became home of the 92nd Bombardment Wing where it operated until 1994 when the 92nd Bomb Wing was re-designated the 92nd Air Refueling Wing and the base was transferred to the Air Mobility Command. Since then it provides air refueling and wing supporting contingency operations around the world and today represents the backbone of the Air Force's west coast tanker fleet.</li> <li>Mission: "Provide responsive, precise air refueling and operational support for the full range of military operations."</li> </ul> <p><b>AFFF Use:</b></p> <p>AFFF containing PFCs was used for firefighting training activities, testing of firefighting equipment, and extinguishing petroleum fires.</p> <p>Sixteen potential AFFF release areas were identified during the PA research by CH2M HILL, with the following three potential AFFF release areas recommended for SI (<b>Figure 2</b>):</p> <ul style="list-style-type: none"> <li>Site FT004 (FT01)</li> <li>Aircraft Crash Location SS008 (PS-4/9)</li> <li>B-52 Crash Location 1994</li> </ul>	<p><b>Topography:</b></p> <ul style="list-style-type: none"> <li>Fairchild AFB is within the Columbia Plateau. The ground surface is relatively flat and slopes towards the northeast. Elevations range from 2,400 to 2,460 feet (ft) above mean sea level (amsl).</li> </ul> <p><b>Surface Water:</b></p> <ul style="list-style-type: none"> <li>"No Name" Creek is the primary pathway for surface runoff at Fairchild AFB. It flows approximately one mile from a stormwater retention pond located south of the runway on the east side of the base, and does not enter another surface water body before flow infiltrates or evaporates. "No Name" Creek is the sole surface water discharge point from the base.</li> <li>Stormwater collected within stormwater drains throughout the base empty into the retention pond.</li> <li>Other surface water runoff not collected by the drains flows to swales that run along the inside of the perimeter fence where the water either infiltrates into the ground or evaporates.</li> </ul> <p><b>Soils:</b></p> <ul style="list-style-type: none"> <li>Alluvial deposits at Fairchild AFB consist of layers of sands and gravels with some silt and clay. These were Quaternary flood deposits from former glacial Lake Missoula of Pleistocene age.</li> </ul> <p><b>Geology:</b></p> <ul style="list-style-type: none"> <li>Surficial sediments consist of up to 50 feet of alluvial sediments composed mostly of sand and gravel with some silt deposits.</li> <li>Underlying the alluvial deposit is a thick sequence of layered basalt associated with the regional Columbia River Basalt Group.</li> <li>The uppermost sequence of basalts is referred to as Basalt A and Basalt B. Basalt A varies in thickness from approximately 160 to 190 ft.</li> <li>Basalts A and B are separated by a low permeability clay referred to as Interbed A.</li> <li>The basalt flows are underlain by massive granitic rock.</li> </ul> <p><b>Hydrogeology:</b></p> <ul style="list-style-type: none"> <li>Groundwater at Fairchild AFB is typically encountered at 3 to 12 ft below ground surface (bgs) in alluvium or within the fractured and weathered upper portion of Basalt A under unconfined conditions.</li> <li>Groundwater within both the alluvium and Basalt A generally flows west to east across Fairchild AFB except for the very western margin of the base, where a groundwater flow divide directs groundwater flow toward the west.</li> </ul>	<p><b>Contaminants of Potential Concern:</b></p> <ul style="list-style-type: none"> <li>Contaminants of Potential Concern are PFCs, which are compounds that are used in formulation of AFFF.</li> <li>Fuel-related compounds and chlorinated solvents are historical site contaminants.</li> </ul> <p><b>Media of Potential Concern:</b></p> <ul style="list-style-type: none"> <li>Soil, groundwater, and sediment.</li> </ul> <p><b>Confirmed or Potential AFFF Release Areas</b></p> <ul style="list-style-type: none"> <li><b>FT004 (FT01)</b> – AFFF used from 1970-1991. Approximately 125 gallons of AFFF were used during each training exercise. Water was drained into an oil-water separator that discharged into a low area east of the training location.</li> <li><b>Calibration Area</b> – AFFF was sprayed onto old taxiway pavement where it could runoff onto unpaved area.</li> <li><b>Aircraft Crash Location SS008 (PS-4/9)</b> – KC-135 crashed in grassy area in March 1987. An unknown amount of AFFF was used to extinguish the fire. AFFF likely infiltrated into the ground.</li> <li><b>B-52 Crash Location 1994</b> – B-52 crashed in grassy field approximately 900 ft. southeast of the tower. Unknown amount of AFFF was used to extinguish the fire.</li> <li><b>Fire Station 1 (Building 3)</b> - According to Assistant Fire Chief, calibration tests have occurred on the paved area directly south of the fire engine garage. The paved area drains through a gap in the curb into a grassy area between the pavement and a wall that divides the fire station from the airstrip.</li> </ul>	<p><b>Potential Receptors:</b></p> <ul style="list-style-type: none"> <li>No Name Creek.</li> <li>Stormwater retention pond on the east side of the base south of the runway.</li> <li>Humans/non-residential, maintenance workers, groundskeepers.</li> <li>Biota – Endangered species at or in the vicinity of the sites.</li> <li>Offsite residences on private wells.</li> </ul>	<p><b>Potential Ecological Receptors:</b></p> <ul style="list-style-type: none"> <li>Inland and aquatic plant species, reptiles, birds, soil invertebrates, and mammals that inhabit or migrate through the installation or are in the vicinity of No Name Creek.</li> </ul> <p><b>Threatened and Endangered Species:</b></p> <p>Threatened species that are known to inhabit Spokane County and may possibly be found within the boundary of Fairchild AFB include the following:</p> <ul style="list-style-type: none"> <li>Bald Eagle (<i>Haliaeetus leucocephalus</i>).</li> <li>Bull Trout (<i>Salvelinus confluentus</i>).</li> <li>Spaldings Catchfly (<i>Silene spaldingii</i>).</li> <li>Water Howellia (<i>Howellia aquatilis</i>).</li> </ul>

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
<p>The following two potential AFFF release areas were added to the SI based on information from the Installation Scoping Visit:</p> <ul style="list-style-type: none"><li>Fire Station 1 (Building 3)</li><li>Current FTA/Calibration Area</li></ul>	<ul style="list-style-type: none"><li>At the eastern side of the base groundwater flow splits around a basalt outcrop resulting in flow towards the northeast and southeast</li></ul> <p><b>Meteorology:</b></p> <ul style="list-style-type: none"><li>The average annual rainfall is 16.6 inches/year.</li><li>The average temperature is 49.4 degrees Fahrenheit (°F).</li><li>The average annual snowfall is 44.9 inches, occurring primarily in the winter months.</li></ul>	<p><b>Primary Release Pathways:</b></p> <ul style="list-style-type: none"><li>Release or application of AFFF to the ground at potential source areas.</li><li>Infiltration of PFCs deeper into the soil column over time potentially reaching groundwater.</li><li>AFFF washed into drainage, stormwater, or sewer system.</li></ul> <p><b>Potential Migration Pathways:</b></p> <ul style="list-style-type: none"><li>Infiltration into groundwater (unconsolidated material, fracture flow, etc.)</li><li>Direct discharge into stormwater collection system</li><li>Adsorption to soil matrix near source</li><li>Topographic controlled migration</li><li>Migration with groundwater flow</li></ul>		

1Sources:  
2CH2M HILL, 2015, Final Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Spokane, Washington. June.  
3Fairchild Air Force Base: A Brief History, March 15, 2016, <http://www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-brief-history>  
4Scoping Visit, September 27, 2016.  
5Weather DB, Fairchild AFB, site visited December 16, 2016, <https://www.weatherdb.com/>

## QAPP WORKSHEET #11: PROJECT/DATA QUALITY OBJECTIVES

The following presents site-specific DQOs for the proposed investigation at Fairchild AFB. These DQOs were developed using USEPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* USEPA QA/G-4 (USEPA, 2006).

### Step 1: State the Problem

AFFF containing PFCs was stored, used, and/or released at Fairchild AFB during firefighting testing and training activities, suppressing petroleum fires, and in hangar fire suppression systems.

### Step 2: Identify the Goals of the Study

The objectives of this study are to:

- Determine if a confirmed release of PFOS and PFOA has occurred;
- Determine if PFOS and PFOA are present in groundwater or surface water at concentrations exceeding the USEPA lifetime HA;
- Determine if PFOS and PFOA are present in soil or sediment at concentrations exceeding calculated RSLs; and
- Identify potential receptor pathways with immediate impact to human health.

As a result of the initial SI, follow-on objectives may include the following:

- Perform follow-up sampling of off-base public/private drinking water wells to identify and verify where PFCs are present in drinking water at concentrations above USEPA HA values and/or state-specific standards and evaluate potential exposure pathways with immediate threats to human health.

### Step 3: Identify Information Input

The following data and information are required to achieve the project goals:

- Collection and laboratory analysis of soil samples from soil borings advanced at areas where AFFF was released at Fairchild AFB;
- Collection and laboratory analysis of groundwater samples from areas where AFFF was released at Fairchild AFB; and
- Collection and laboratory analysis of a sediment sample from a surface water body where AFFF may have been discharged at Fairchild AFB.

Follow-on objectives and informational inputs, as applicable, will be provided in addenda to this ISWP as needed.

**Step 4: Define the Boundaries of Data Collection**

The five AFFF release areas at Fairchild AFB include locations where AFFF was determined to be released. The investigation boundaries are depicted on the attached area-specific figures that illustrate the features and proposed sampling locations at each of the five AFFF release areas at Fairchild AFB. The investigation is defined vertically by the depth of groundwater.

**Step 5: Develop the Analytical Approach**

Analytical data will include the analysis of the following 16 PFCs by Modified USEPA Method 537 using liquid chromatography-tandem mass spectrometry (LC-MS/MS):

- PFOS;
- PFOA;
- PFBS;
- Perfluoroheptanoic acid (PFHpA);
- Perfluorohexane sulfonic acid (PFHxS);
- Perfluorononanoic acid (PFNA);
- Perfluorobutanesulfonic acid (PFBS);
- N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA);
- N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA);
- Perfluorodecanoic acid (PFDA);
- Perfluorotetradecanoic acid (PFTA);
- Perfluorododecanoic acid (PFDoA);
- Perfluorohexanoic acid (PFHxA);
- Perfluorotridecanoic acid (PFTrDA);
- Perfluoroundecanoic acid (PFUnA);
- 6:2 Fluorotelomer sulfonate (6:2 FTS); and
- 8:2 Fluorotelomer sulfonate (8:2 FTS).

One soil sample per boring will also be collected and submitted for analysis of physiochemical properties, including soil potential of hydrogen (pH; USEPA Method 9045B), particle size analysis (American Society for Testing and Materials [ASTM] D422), and total organic carbon (TOC) content (USEPA 9060 or Lloyd Kahn Method).

## **Release Determination**

In accordance with Interim AF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations (USAF, 2012) and USEPA HA values for PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b), a release will be considered confirmed if exceedances of the following concentrations are identified:

### **PFOS**

- 0.07 µg/L in groundwater/surface water that is used as or contributes to a drinking water source (combined with PFOA value).
- 1,260 µg/kg in soil (calculated, in the absence of regional screening-level values).
- 1,260 µg/kg in sediment (calculated in the absence of regional screening-level values).

### **PFOA**

- 0.07 µg/L in groundwater/surface water that is used as or contributes to a drinking water source (combined with PFOS value).
- 1,260 µg/kg in soil (calculated, in the absence of regional screening-level values).
- 1,260 µg/kg in sediment (calculated in the absence of regional screening-level values).

While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the SI, USEPA has also derived RSL values for PFBS for which there is a Tier 2 toxicity value (Provisional Peer Review Toxicity Value). The USAF will also consider a release to be confirmed if exceedances of the following concentrations are identified:

### **PFBS**

- 380 µg/L in groundwater/surface water.
- 1,600,000 µg/kg in soil and sediment.

**Drinking Water Source Assessment:** If PFCs are identified at concentrations exceeding USEPA HA values, RSLs, and/or concentrations established by state regulations in downgradient installation boundary monitoring wells, and a potential migration pathway is identified to downgradient drinking water supplies, then public/drinking water wells will be sampled.

**Protect Human Health:** If PFCs are identified at concentrations exceeding USEPA HA values, RSLs, and/or state-specific standards in public/private drinking water wells, then the USAF will be contacted to evaluate the mitigation measures that may be necessary. Mitigation measures will be applied to private drinking water wells that present an imminent threat to human health from PFCs related to USAF activities at the installation.

**Step 6: Specify Performance or Acceptance Criteria**

- Daily standardized PFC personal protective equipment (PPE)/equipment checklist (provided in the PFC protocol standard operating procedure [SOP]) will be completed by the field manager. The quality assurance (QA) manager will review and accept the final checklist.
- QA manager or designee will verify field procedures defined in the QPP and ISWP are properly followed through field audits. Any deviations will be promptly communicated, addressed, and documented.
- Analytical laboratories will carry current accreditation.
- The laboratories will analyze proficiency testing samples to demonstrate capability prior to the sampling program beginning. The laboratories will identify and quantify proficiency testing samples within acceptance limits to verify reporting of PFCs. Any findings or recommendations will be addressed prior to analysis of field samples.
- The project chemist will conduct an audit prior to sampling to evaluate laboratory procedures, quality program, and operations to verify the analytical procedure. Any findings or recommendations will be addressed prior to analysis of field samples.
- PFCs analysis by LC-MS/MS will provide acceptable detection limits to confirm presence of PFCs at concentrations defined in Step 5 herein and **QAPP Worksheet #15** of the General QPP (Amec Foster Wheeler, 2016).
- USEPA Stage 2B data verification will be conducted on 100 percent of the data and USEPA Stage IV data validation will be conducted on 10 percent of the analytical data by an experienced chemist to assess the data usability. The data usability will then be evaluated by the appropriate agencies for final approval. Data completeness of 90 percent usable data is required.
- The SI report will be reviewed and accepted by AFCEC.

**Step 7: Develop the Detailed Plan for Obtaining Data**

The detailed plan for obtaining the data is presented in the following **QAPP Worksheets: #13, #14/16, #17, #18, and #20**. SOPs for collecting environmental samples (groundwater, soil, and sediment) that will be used during this investigation are provided in Appendix D of the General QPP.

### QAPP WORKSHEET #13: SECONDARY DATA USES AND LIMITATIONS

The primary sources of data used to generate the history, meteorology, hydrogeology, hydrology, ecological receptors, and AFFF use at Fairchild AFB that are included in this ISWP are identified below.

Data Type	Source	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Geology, hydrology, and hydrogeology; AFFF use; ecological receptors	CH2M HILL, 2015, <i>Final Preliminary Assessment Report for Perfluorinated Compounds at Fairchild Air Force Base, Washington</i> . June.	Provided geologic and hydrogeologic setting and historical and current AFFF use.	Assessments were developed based upon reporting of others and/or interviews of former installation personnel.
Site history	USAF, 2016. <i>Fairchild Air Force Base: A Brief History</i> at <a href="http://www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-brief-history">www.fairchild.af.mil/About-Us/Fact-Sheets/Display/Article/238991/fairchild-air-force-base-a-brief-history</a> , published 15 March.	Provided base operational history.	None known.





## **QAPP WORKSHEET #14/16: PROJECT TASKS AND SCHEDULE**

To meet the project goals defined in **QAPP Worksheet #11**, the Fairchild AFB SI will include site reconnaissance to determine the scope of sampling activities, as well as the collection of soil, sediment, and groundwater samples to confirm if a release of PFCs has occurred. The approach to conducting the SI will include the activities identified in this **QAPP Worksheet #14/16**. Fieldwork will be conducted in accordance with the SOPs provided in Appendix D of the General QPP.

### **INSTALLATION SCOPING VISITS**

An Installation Scoping Visit was held on 27 September 2016 by Amec Foster Wheeler personnel to review available data, interview applicable Fairchild AFB personnel, and visit each proposed AFFF area to identify site-specific sampling locations and constraints. Five potential AFFF areas were identified during the scoping visit and are proposed for further investigation. Refer to **QAPP Worksheet #9** for details.

### **PRE-MOBILIZATION ACTIVITIES**

The following activities will be completed prior to mobilization to Fairchild AFB to perform SI field activities.

#### ***Health and Safety Plan Preparation***

The Installation-Specific HSP is included in **Appendix A**, and is a supplement to the General HSP found in Appendix A of the General QPP. The HSP will be reviewed and updated, if necessary, prior to field mobilization based on final personnel assignments. The HSP has been prepared in accordance with the Occupational Safety and Health Administration's Hazardous Waste Operations and Emergency Response Standard (29 Code of Federal Regulations [CFR] 1910.120 CFR).

Amec Foster Wheeler will also review all subcontractor HSPs and training records for subcontracted personnel to ensure compliance with Amec Foster Wheeler's General HSP.

#### ***Base Access***

Amec Foster Wheeler field personnel and their drilling subcontractor will provide the Fairchild AFB RPM all personal information required for access to Fairchild AFB a minimum of 30 days prior to initiation of field activities. Passes will be obtained at the Fairchild AFB main gate Visitor Center on the first day of mobilization.

#### ***Utility Clearance***

Amec Foster Wheeler will pre-mark all proposed boring locations. Utility clearance at each location will be obtained by completing the following activities:

- Obtain utility clearances and a dig permit ticket through Inland Empire Utility Coordinating Council (1-800-424-5555 or 811) a minimum of two business days and not more than ten business days prior to mobilization of drilling equipment;
- Notify Fairchild AFB Civil Engineer (CE) department of all utility clearances;

- Review available utility plans for identification of potential utilities in work areas; and
- Clear all intrusive locations by the drilling subcontractor using a hand auger, post-hole digger, or air knife to a minimum depth of 5 ft bgs.

A base-specific dig permit will also be required. Amec Foster Wheeler will stake locations a minimum of one month in advance of field work, and will provide location information to Mr. Connally for dig permit approval; dig permits will be kept on site during field work.

#### ***Area-Specific Regulations/Permits***

A Federal Aviation Administration (FAA) permit will be obtained for soil boring/monitoring well installations utilizing a drill rig on the active airfield at Fairchild AFB, if required upon consultation with the USAF. Amec Foster Wheeler will submit all required information to Ms. Roberta LaPorte, Airfield Manager, a minimum of 45 days prior to field work initiation, including anticipated field work dates and duration, boring/well Global Positioning System (GPS) coordinates and elevations, drill rig type and mast heights (lowered and raised), and well development method.

#### ***Field Readiness Review***

Amec Foster Wheeler will conduct a Field Readiness Review that will include the preparation of a checklist to ensure all permits, procurement items, and notifications have been submitted and/or approved. This information will be discussed during a teleconference with the RPM and AFCEC personnel a minimum of two weeks prior to field work mobilization. Notification to the Washington Department of Ecology (Ecology) and USEPA will be provided by the RPM within the applicable timeframe.

#### **MOBILIZATION/DEMOBILIZATION**

Three mobilizations to the installation will be required to complete the SI work. The first mobilization will be to sample existing monitoring wells in the FT004 area. The second mobilization will be to mark boring locations and verify utility clearance with the base CE, and the third mobilization will be to advance soil borings and collect soil, groundwater, and sediment samples.

#### **ENVIRONMENTAL SAMPLING**

Soil, sediment, and/or groundwater samples will be collected at the five identified AFFF release areas at Fairchild AFB. The goal of site-specific sampling is to determine the presence or absence of PFCs within media of concern. **QAPP Worksheets #18-1 through #18-5** and **Figures 3 through 7** provide the sampling details and locations, respectively, for each potential AFFF release area at Fairchild AFB. All environmental samples collected will be analyzed for the 16 PFC compound analytical suite listed in **QAPP Worksheet #11**.

One soil sample per boring will also be collected and submitted for geotechnical analyses of physiochemical properties, including soil pH (USEPA Method 9045B), particle size analysis (ASTM D422), and TOC (USEPA 9060 or Lloyd Kahn Method). The General QPP provides the SOPs and descriptions for

sampling activities, while a summary of the proposed field sampling activities is described in the following sections.

### ***Soil Boring Advancement/Abandonment and Soil Sampling***

Twelve soil borings will be advanced by a Washington licensed driller using direct push technology (DPT), air rotary, and/or roto sonic drilling methodology to identify the presence or absence of PFCs in soil at the five AFFF release areas at Fairchild AFB, as well as to characterize subsurface conditions. Soil cores will be continuously collected to the appropriate depth or drill cuttings will be collected at discrete depths, screened with a photoionization detector for volatile organic vapors, and logged by a qualified geoscientist in accordance with the Unified Soil Classification System or appropriate rock core descriptions.

Discrete surface and subsurface vadose-zone soil samples will be collected for laboratory analysis from each of the soil borings at specified depths during soil boring advancement. Specific details and procedures related to soil sample collection can be found in SOP AFW-02, *Soil Sampling* (Appendix D, General QPP). The boreholes will be abandoned in accordance with SOP AFW-06, *Borehole Abandonment* (Appendix D, General QPP). **QAPP Worksheets #17 and #18** provide further discussion of sample locations and rationale. Soil sample collection details will be recorded in field logs and soil sample collection logs, while boring lithology will be recorded on drilling logs (Appendix E, General QPP).

### ***Grab Groundwater Sampling from Borings***

Where groundwater samples are to be collected from borings, a 2-inch-diameter 0.02-inch machine slotted polyvinyl chloride (PVC) well screen and casing will be temporarily placed in the open borehole or retracted core barrel to the boring total depth. Low-flow groundwater purging and sampling will be conducted using a peristaltic pump fitted with disposable high-density polyethylene tubing. Water levels and quality parameters (pH, specific conductance, temperature, oxidation-reduction potential [ORP], dissolved oxygen [DO], and turbidity) will be periodically measured with a multi-purpose water quality meter and turbidity meter until all parameters stabilize in accordance with SOP AFW-03, *Groundwater Sampling* (Appendix D, General QPP), or until a minimum of 5 borehole volumes of water have been removed or for a maximum of 30 minutes. The water quality parameter measurements will be recorded on groundwater sample collection logs during purging activities. A summary of proposed groundwater samples is provided in **QAPP Worksheet #18**.

### ***Monitoring Well Sampling***

Static depth to groundwater measurements will be collected from existing monitoring wells at each site for use in potentiometric level calculation and groundwater contouring prior to initiating groundwater sampling activities. Low-flow groundwater purging and sampling will be conducted from 8 existing monitoring wells with a peristaltic pump fitted with disposable high-density polyethylene tubing. Water levels and quality parameters (pH, specific conductance, temperature, ORP, DO, and turbidity) will be periodically measured with a multi-purpose water quality meter and turbidity meter until all parameters stabilize in accordance with SOP AFW-03, *Groundwater Sampling* (Appendix D, General QPP). The water

levels and quality parameter measurements will be recorded on groundwater sample collection logs during purging activities. A summary of proposed groundwater samples is provided in **QAPP Worksheet #18**.

#### ***Sediment Sample Collection***

One sediment sample will be collected from the retention pond near the eastern base boundary (as part of the investigation of potential releases at Fire Station 1 to determine the presence or absence of PFCs in sediment. The sediment sample will be collected using either a core sampler or by hand using stainless steel spoons or cups mounted on poles as necessary, depending on location-specific conditions. A summary of the proposed sediment sampling is provided in **QAPP Worksheet #18**, and specific details and procedures related to sediment sample collection can be found in SOP AFW-07, *Sediment Sampling* (Appendix D, General QPP).

#### **PFC SAMPLING CONSIDERATIONS**

Given the low detection limits associated with PFC analysis and the many potential sources of trace levels of PFCs, field personnel will follow strict protocols to help mitigate the potential for false detections of PFCs. A list of prohibited and acceptable clothing/equipment for sampling at PFC sites is provided in Table 3 of the General QPP. Specific details and procedures related to sampling for analysis of PFCs can be found in SOP AFW-01, *PFC-Specific Procedures* (Appendix D, General QPP).

#### **INVESTIGATION-DERIVED WASTE MANAGEMENT**

IDW will consist of soil cuttings from soil boring advancement, well development water, groundwater sampling purge water, decontamination water, disposable personal protective equipment (PPE), and other miscellaneous refuse. PPE and other miscellaneous refuse will be placed in plastic bags and discarded in an on-site sanitary trash container for disposal at a sanitary landfill. Soil IDW generated from soil boring and monitoring well installation activities will be placed into Department of Transportation (DOT)-approved 55-gallon, open-top steel drums. Liquid IDW generated from equipment decontamination, and monitoring well development and purging activities will be placed into DOT-approved 55-gallon steel drums. IDW containers will be appropriately labeled with site/contact information and contents, and will be staged in Building 2411 or other area designated by base managers. Based upon waste characterization results, IDW will be profiled and transported off-site by a licensed waste hauler to a permitted disposal facility. A designated USAF representative will oversee IDW loading for transport and disposal and will sign all manifests/bills of lading. Copies of the bills of lading/manifests will be included in the SI Report.

#### ***Soil IDW***

An aliquot of soil will be collected from each soil core during soil boring advancement and stored in an appropriate container (e.g., 5-gallon bucket with lid or sealable bag). The required sample volume will be collected from the composited soil sample and transferred directly into laboratory-provided containers, labeled, packed on ice in insulated coolers, and delivered under chain-of-custody protocol to the selected

laboratory. The samples will be analyzed for toxicity characteristic leaching procedure volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, herbicides, and metals; polychlorinated biphenyls; total petroleum hydrocarbons (gasoline range organics [GRO] and diesel range organics [DRO]); and flashpoint, pH, sulfide, and cyanide, to determine the applicable disposal option.

#### **Liquid IDW**

The liquid IDW will be segregated into separate containers for monitoring well development/purge water and equipment decontamination water and sampled separately in an effort to reduce the volume of hazardous waste should either waste stream be characterized as such.

An aliquot of water will be collected from each drum of equipment decontamination and monitoring well development and purge water at the conclusion of drilling and sampling activities using a dedicated bailer. The samples will be decanted directly into laboratory-provided containers, labeled, packed on ice in insulated coolers, and delivered under chain-of-custody protocol to the selected laboratory. The samples will be analyzed for VOCs, SVOCs, pesticides, herbicides, metals, polychlorinated biphenyls, total petroleum hydrocarbons (GRO and DRO), flashpoint, pH, sulfide, and cyanide, to determine the applicable disposal option.

#### **PROPOSED SITE INSPECTION SCHEDULE**

The projected schedule for completion of SI activities is summarized below.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
<b>Installation Scoping Visit</b> – A scoping visit was made to the installation to conduct interviews with personnel familiar with AFFF use, review information and inspect potential AFFF release areas, and determine logistical information required for the SI field work.	Amec Foster Wheeler	9/27/16	9/27/16	Scoping visit notes from interviews, activities planned for each of the AFFF release areas, and installation logistical information. Submitted to USAF and USEPA prior to a scoping call on 11/14/16.	11/07/16
<b>UFP-QAPP Installation-Specific Work Plan</b> – This document will be generated using information gathered from the installation scoping visit, including information provided by AFCEC and Fairchild AFB personnel.	Amec Foster Wheeler	9/27/16	12/21/16	UFP-QAPP Installation-Specific Work Plan.	12/21/16

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
<b>Readiness Review</b> – A readiness review will be conducted prior to mobilization to the installation to ensure that the field crew has the proper sampling equipment, sample containers, PPE, site clearances, sample locations, and any miscellaneous materials necessary to conduct the SI field work.	Amec Foster Wheeler	1/10/17	1/10/17	Results of the readiness reviews will be included in the SI Report.	7/7/17
<b>FT004 (FT01) Monitoring Well Sampling</b> – Groundwater samples will be collected from FT004 wells MW-3, MW-225, MW-226, and MW-50 to evaluate the impact to groundwater in the area prior to the remaining soil/groundwater investigation tasks.	Amec Foster Wheeler	1/24/17	1/25/17	Results will be provided to AFCEC upon receipt toward determining whether off-base wells will be sampled. Results of the groundwater sampling will also be included in the SI Report.	2/10/17
<b>Utility Clearance</b> – All soil boring locations will be located and marked, and verified to ensure no underground utilities will be compromised.	Amec Foster Wheeler	4/4/17	4/4/17	Description of the utility clearance activities will be included in the SI Report.	7/7/17
<b>SI Subsurface Field Activities</b> – Field activities will be conducted at the five AFFF release areas, including collection of soil, groundwater, and sediment samples for PFC analysis.	Amec Foster Wheeler and Subcontracted Drilling Company	4/17/17	4/21/16	SI field information will be included in the SI Report.	7/7/17
<b>Laboratory Data Validation</b> – Validation of the field sampling analytical data will be conducted for each sample data group.	Amec Foster Wheeler	5/8/17	6/2/17	Information to be included in the SI Report.	7/7/17
<b>SI Report</b> – This report will be prepared based upon the data generated during the SI field activities, and will include geology/hydrogeology, CSM, sampling locations and depths, validated analytical results, and comparison of results to project action limits for the determination of whether a PFC release has occurred in environmental media at each area.	Amec Foster Wheeler	5/8/17	8/7/17	SI Report.	8/7/17

- 1 **Notes:**
- 2 AFB - Air Force Base
- 3 AFCEC - Air Force Civil Engineer Center
- 4 AFFF - aqueous film forming foam
- 5 DD - day
- 6 MM - month
- 7 PFC - perfluorinated compound
- 8 PPE - personal protective equipment
- 9 QAPP - quality assurance project plan
- 10 RPM - Remedial Project Manager
- 11 SI - Site Inspection
- 12 UFP - Uniform Federal Policy
- 13 YY - year





## **QAPP WORKSHEET #17: SAMPLING DESIGN AND RATIONALE**

### **PROPOSED SCOPE OF WORK**

Amec Foster Wheeler has developed a sampling program designed to evaluate the potential release of AFFF from FTAs, firefighting equipment testing areas, aircraft crash sites, and AFFF discharge locations at Fairchild AFB. The sampling plan is based on:

- Discussions between Amec Foster Wheeler and AFCEC during the installation visit on 27 September 2016;
- Review of background documents; and
- Development of a preliminary basewide CSM (**QAPP Worksheet #10**).

Sampling at Fairchild AFB is being performed at the locations most likely to have been previously impacted with AFFF from USAF activities, as well as from selected existing monitoring wells located hydraulically downgradient of AFFF release areas. The sampling rationale and locations for each of the five AFFF release areas are detailed below.

#### ***AFFF Release Area 1: FT004 (FT01)***

Surface and subsurface soil samples will be collected from two borings advanced within and downgradient from former burn pit excavation area. Groundwater samples will also be collected from existing shallow monitoring well MW-3 located near the source area and shallow monitoring wells MW-225, MW-226, and MW-50 located downgradient of the former burn pit near the installation boundary. The samples from the installation boundary are to evaluate whether PFCs above HA levels are likely migrating off-base toward downgradient residential supply wells. The proposed soil and groundwater sample locations for FT004 (FT01) are illustrated on **Figure 3**.

If concentrations of PFCs in the boundary wells (MW-225, MW-226, and/or MW-50) exceed HA levels, off-base private supply wells will be sampled to determine the presence or absence of PFCs. Off-base private supply wells near FT004 (FT01) are illustrated on Figure 4. The scope of the off-base sampling, if needed, will be included in a brief addendum to this ISWP.

#### ***AFFF Release Area 2: Calibration Area***

Surface and subsurface soil samples and one groundwater sample will be collected from two borings located south of the current FTA where equipment calibration was performed. The proposed soil and groundwater sample locations for the current FTA are illustrated on **Figure 3**.

#### ***AFFF Release Area 3: Aircraft Crash Location SS008 (PS-4/9)***

Surface and subsurface soil samples will be collected from three borings located in the crash area boundary. Groundwater samples will be collected from three existing shallow groundwater monitoring wells within and immediately downgradient from the crash location (wells MW-438, MW-265, and MMW-1023-1). The proposed soil and groundwater sample locations for the aircraft crash location SS008 (PS-4/9) are illustrated on **Figure 5**.

**AFFF Release Area 4: B52 Crash Location 1994**

Surface and subsurface soil and groundwater samples will be collected from three borings located in the crash area boundary. The proposed soil and groundwater sample locations for the B52 crash location 1994 are illustrated on **Figure 6**.

**AFFF Release Area 5: Fire Station 1 (Building 3)**

Surface and subsurface soil samples will be collected from two borings in the vicinity of the curb gap and within a low spot in the grassy area at Fire Station 1. A groundwater sample will be collected from the boring in the vicinity of the curb gap (FS1-SB-1), and a second groundwater sample will be collected from existing shallow monitoring well MW-399. One sediment sample will be collected from the bottom of the retention pond that receives base storm water. The proposed sediment and surface water sample location is illustrated on **Figure 3**.

The proposed number of samples by medium (surface soil, subsurface soil, groundwater, and sediment) to be collected at each AFFF release area described above are summarized in **Table 4**.

1 **Table 4. Proposed Samples per Medium at Each AFFF Release Area.**

Site	Surface Soil Samples	Subsurface Soil Samples	Groundwater Samples	Sediment Samples
<b>FT004 (FT01)</b> (AFFF Release Area 1)	1	3	4	0
<b>Calibration Area</b> (AFFF Release Area 2)	2	2	1	0
<b>Aircraft Crash Location SS008 (PS-4/9)</b> (AFFF Release Area 3)	3	3	3	0
<b>B-52 Crash Location 1994</b> (AFFF Release Area 4)	3	3	3	0
<b>Fire Station 1 (Building 3)</b> (AFFF Release Area 5)	2	2	2	1
<b>Total Regular Samples</b>	<b>11</b>	<b>13</b>	<b>13</b>	<b>1</b>
<b>Field Duplicates</b>	1	2	2	1
<b>Matrix Spike/Matrix Spike Duplicates</b>	1	2	2	1
<b>Equipment Rinsate Blanks</b>	TBD	TBD	TBD	TBD
<b>Field Blanks</b>	TBD	TBD	TBD	TBD
<b>Total Samples</b>	<b>TBD</b>	<b>TBD</b>	<b>TBD</b>	<b>TBD</b>

- 2 **Notes:**  
3 AFFF - aqueous film forming foam  
4 FTA - fire training area



**QAPP WORKSHEET #18-1: SAMPLING LOCATIONS AND METHODS**  
**AFFF RELEASE AREA 1: FT004 (FT01)**

Sample locations are illustrated on Figure 3. The proposed sampling summary for AFFF Release Area 1 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
FRCHD01-SB-1	FRCHD01-SO-001	Subsurface Soil	4	4.5	DPT	New	Assess PFC presence in soil beneath the former burn pit excavation.
	FRCHD01-SO-002	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
FRCHD01-SB-2	FRCHD01-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil adjacent to the former burn pit excavation.
	FRCHD01-SO-004	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
MW_3	FRCHD01-GW-001	Groundwater	4	9	PP	Existing	Assess PFC presence in groundwater near the former burn pit
MW_225	FRCHD01-GW-002	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	Existing	Assess PFC presence in groundwater at the downgradient installation boundary.
MW_226	FRCHD01-GW-003	Groundwater	15	16	PP	Existing	Assess PFC presence in groundwater at the downgradient installation boundary.
MW_50	FRCHD01-GW-004	Groundwater	6	16	PP	Existing	Assess PFC presence in groundwater at the downgradient installation boundary.

**Notes:**

<sup>a</sup> Subsurface soil samples will be collected above the groundwater interface or above bedrock, whichever is shallower. Actual sampling depth will be determined in the field during drilling operations.

<sup>b</sup> Monitoring well screened interval information is not currently available.

GW – groundwater

ID – identification

MW – monitoring well

PFC – perfluorinated compound

PP – peristaltic pump

SO – soil

TBD – to be determined

**QAPP WORKSHEET #18-2: SAMPLING LOCATIONS AND METHODS**  
**AFFF RELEASE AREA 2: CALIBRATION AREA**

Sample locations are illustrated on Figure 3. The proposed sampling summary for AFFF Release Area 2 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
FRCHD02-SB-1	FRCHD02-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil at current FTA calibration area.
	FRCHD02-SO-002	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
FRCHD02-SB-2	FRCHD02-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil and groundwater at current FTA calibration area.
	FRCHD02-SO-004	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
	FRCHD02-GW-001	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	New	

**Notes:**

<sup>a</sup> Subsurface soil samples will be collected above the groundwater interface or above bedrock, whichever is shallower. Actual sampling depth will be determined in the field during drilling operations.

<sup>b</sup> Sample collection depth will be based on depth to groundwater determined in the field during drilling operations.

AFFF – aqueous film forming foam

DPT – direct push technology

ft bgs – feet below ground surface

FTA = Fire Training Area

GW – groundwater

ID – identification

PFC – perfluorinated compound

PP – peristaltic pump

SO – soil

TBD – to be determined

**QAPP WORKSHEET #18-3: SAMPLING LOCATIONS AND METHODS**  
**AFFF RELEASE AREA 3: AIRCRAFT CRASH LOCATION SS008 (PS-4/9)**

Sample locations are illustrated on Figure 5. The proposed sampling summary for AFFF Release Area 3 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
FRCHD03-SB-1	FRCHD03-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil within crash area boundary.
	FRCHD03-SO-002	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
FRCHD03-SB-2	FRCHD03-SO-003	Surface Soil	0	0.5	Hand Auger	New	
	FRCHD03-SO-004	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
FRCHD03-SB-3	FRCHD03-SO-005	Surface Soil	0	0.5	Hand Auger	New	
	FRCHD03-SO-006	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
MW_438	FRCHD03-GW-001	Groundwater	7.5	12.5	PP	Existing	Assess PFC presence in groundwater downgradient from crash area.
MW_265	FRCHD03-GW-002	Groundwater	10	20	PP	Existing	
MMW_1023-1	FRCHD03-GW-003	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	Existing	

**Notes:**

<sup>a</sup> Subsurface soil samples will be collected above the groundwater interface or above bedrock, whichever is shallower. Actual sampling depth will be determined in the field during drilling operations.

<sup>b</sup> Monitoring well screened interval information is not currently available.

AFFF – aqueous film forming foam

DPT – direct push technology

ft bgs – feet below ground surface

GW – groundwater

ID – identification

MW – monitoring well

PFC – perfluorinated compound

PP – peristaltic pump

SB – soil boring

SO – soil

TBD – to be determined

**QAPP WORKSHEET #18-4: SAMPLING LOCATIONS AND METHODS**  
**AFFF RELEASE AREA 4: B-52 CRASH LOCATION 1994**

Sample locations are illustrated on Figure 6. The proposed sampling summary for AFFF Release Area 4 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
FRCHD04-SB-1	FRCHD04-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil and groundwater in crash area boundary.
	FRCHD04-SO-002	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
	FRCHD04-GW-001	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	New	
FRCHD04-SB-2	FRCHD04-SO-003	Surface Soil	0	0.5	Hand Auger	New	
	FRCHD04-SO-004	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
	FRCHD04-GW-002	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	New	
FRCHD04-SB-3	FRCHD04-SO-005	Surface Soil	0	0.5	Hand Auger	New	
	FRCHD04-SO-006	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
	FRCHD04-GW-003	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	New	

**Notes:**

<sup>a</sup> Subsurface soil samples will be collected above the groundwater interface or above bedrock, whichever is shallower. Actual sampling depth will be determined in the field during drilling operations.

<sup>b</sup> Sample collection depth will be based on depth to groundwater determined in the field during drilling operations.

AFFF – aqueous film forming foam

DPT – direct push technology

ft bgs – feet below ground surface

ID – identification

PFC – perfluorinated compound

GW – groundwater

SB – soil boring

TBD – to be determined

PP – peristaltic pump

SO – soil



**QAPP WORKSHEET #18-5: SAMPLING LOCATIONS AND METHODS**  
**AFFF RELEASE AREA 5: FIRE STATION 1 (BUILDING 3)**

Sample locations are illustrated on Figures 3 and 5. The proposed sampling summary for AFFF Release Area 5 is presented below.

Location ID	Sample ID	Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Sample Method	New or Existing Location	Sample Rationale
FRCHD05-SB-1	FRCHD05-SO-001	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil and groundwater near curb gab that receives drainage during calibration testing.
	FRCHD05-SO-002	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
	FRCHD05-GW-001	Groundwater	TBD <sup>b</sup>	TBD <sup>b</sup>	PP	New	
FRCHD05-SB-2	FRCHD05-SO-003	Surface Soil	0	0.5	Hand Auger	New	Assess PFC presence in soil in low spot in grassy area that receives drainage during calibration testing.
	FRCHD05-SO-004	Subsurface Soil	5 <sup>a</sup>	15 <sup>a</sup>	DPT	New	
MW_399	FRCHD05-GW-002	Groundwater	7	17	PP	Existing	Assess PFC presence in groundwater downgradient of potential source area.
FRCHD05-SD-1	FRCHD05-SD-001	Sediment	0	1	Core/Scoop	New	Assess PFC presence in sediment in retention pond that receives base stormwater.

**Notes:**

<sup>a</sup> Subsurface soil samples will be collected above the groundwater interface or above bedrock, whichever is shallower. Actual sampling depth will be determined in the field during drilling operations.

<sup>b</sup> Sample collection depth will be based on depth to groundwater determined in the field during drilling operations.

AFFF – aqueous film forming foam

DPT – direct push technology

ft bgs – feet below ground surface

GW – groundwater

ID – identification

MW – monitoring well

PFC – perfluorinated compound

PP – peristaltic pump

SD – sediment

SO – soil

TBD – to be determined



## QAPP WORKSHEET #20: FIELD QC SUMMARY

The installation wide field QC summary is presented below. Field duplicate and matrix spike/matrix spike duplicate (MS/MSD) frequencies are determined based on the total number of samples for each medium. Equipment rinsate blanks will be collected at a rate of 1 per non-dedicated piece of equipment, per day, per crew. As a result, the number of equipment rinsate blanks will be determined in the field. Field blanks will be determined in the field based on the sources of PFC-free water.

Matrix	Analyte	Regular Samples	Field Duplicates (1:10)	Equipment Rinsate (1:10 for each piece of equipment per day)	Field Blanks (1 per lot of PFC-free water)	MS/MSDs (1:10)	Total Samples
Soil	PFCs	24	3	TBD	TBD	3	TBD
Groundwater	PFCs	13	2	TBD	TBD	2	TBD
Sediment	PFCs	1	1	TBD	TBD	1	TBD
<b>TOTALS</b>		<b>38</b>	<b>6</b>	<b>TBD</b>	<b>TBD</b>	<b>6</b>	<b>TBD</b>

**Notes:**

MS/MSD – matrix spike/matrix spike duplicate

PFC – perfluorinated compound

TBD – To be determined



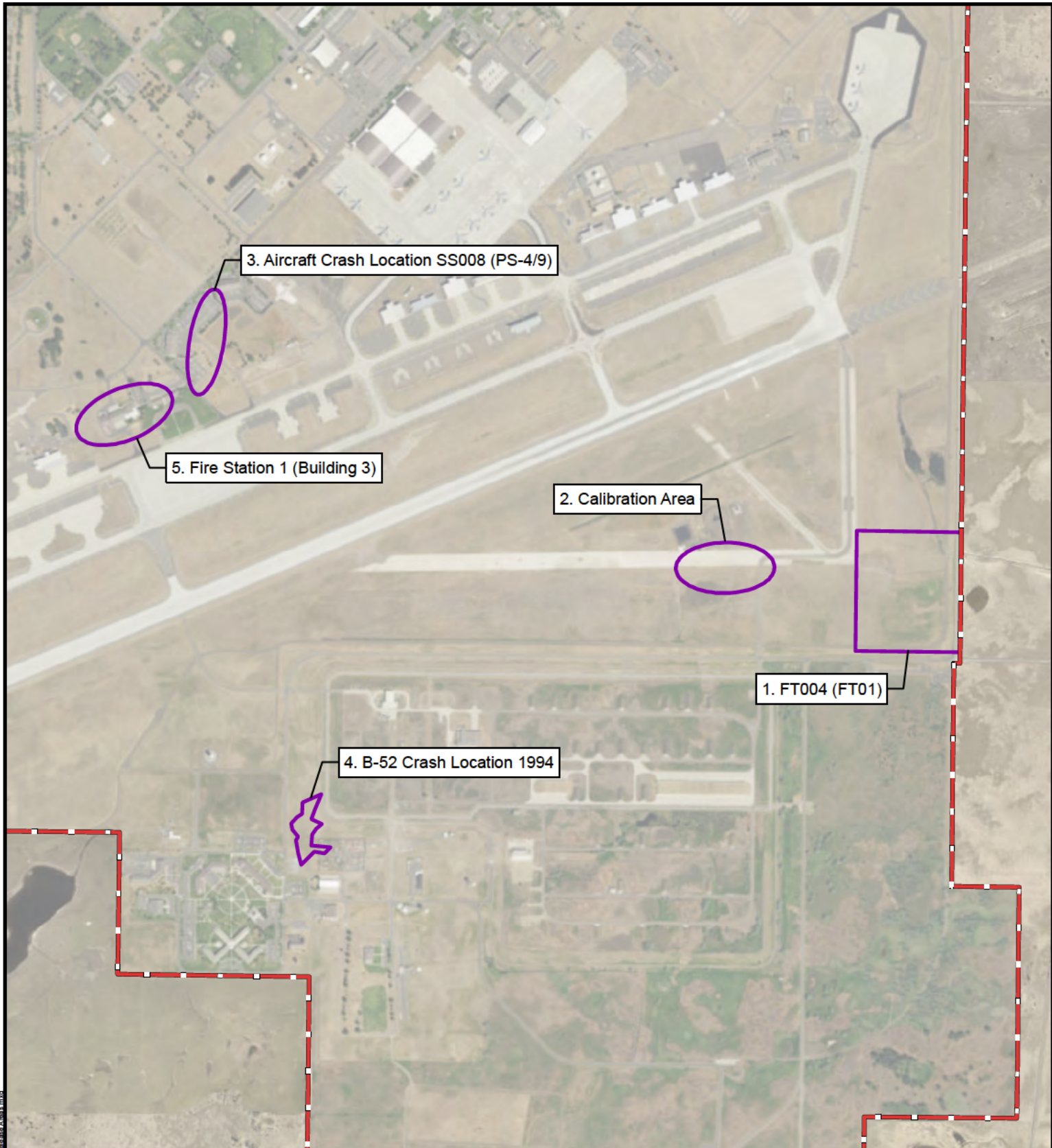












# **Air Force Civil Engineer Center**



2261 Hughes Avenue  
Building 171, Suite 155  
JBSA Lackland, Texas 78236



Project: 775303101

By: SD

Date: 12/21/2016

0 750 1,500 Feet

## **Symbol Key**

- Potential AFFF Release Area
- Fairchild AFB Installation Boundary

Disclaimer: For general reference purposes only.  
This is not a survey product.  
DO NOT USE to determine, certify, or verify  
map features, scale and/or other information.

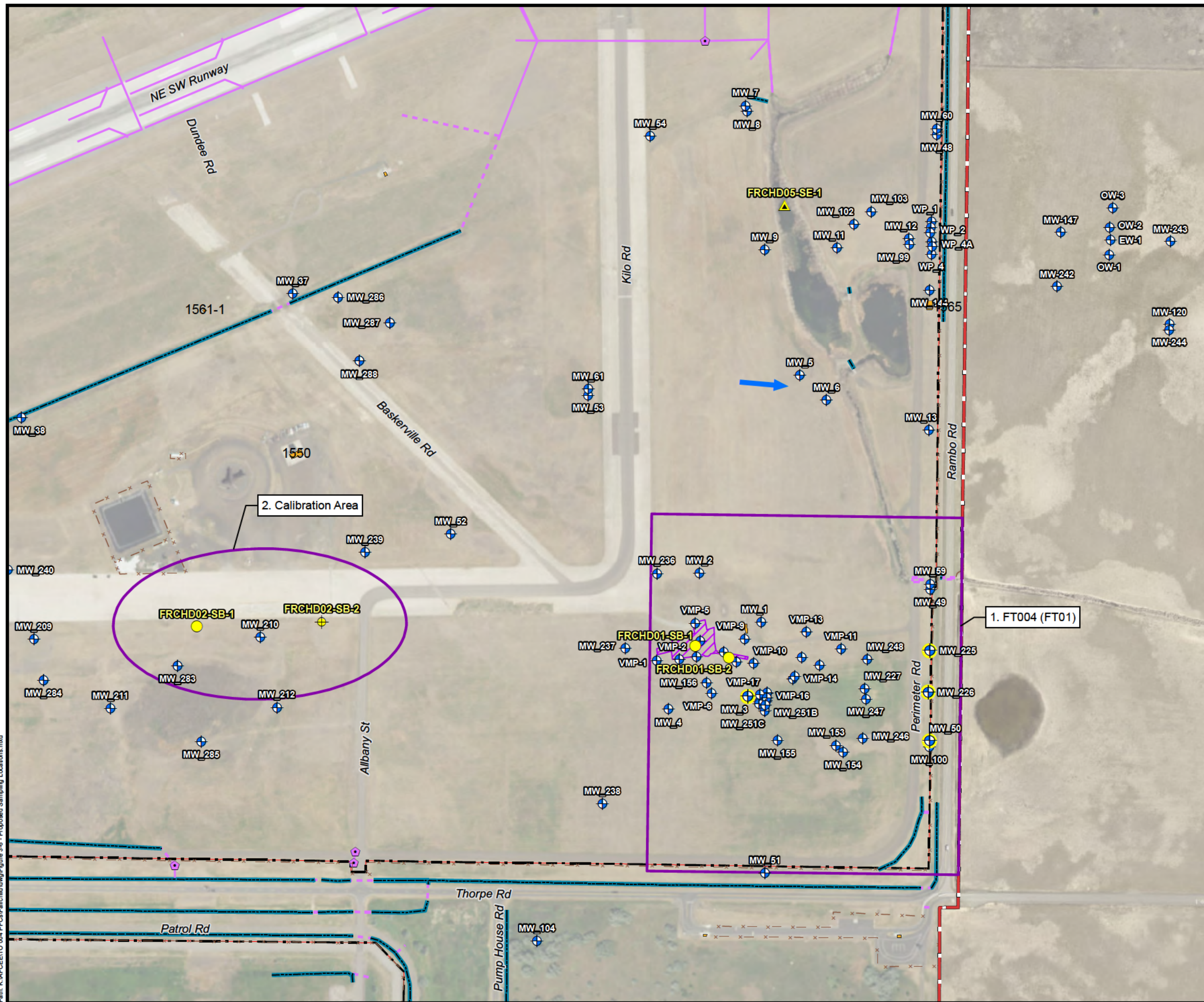
Source: Esri, DigitalGlobe, GeoEye,  
Earthstar Geographics, CNES/Airbus DS,  
USDA, USGS, AeroGR D, IGN, and the  
GIS User Community

**FIGURE 2**  
**Proposed AFFF Release Areas**  
**for Site Inspection**  
**Fairchild Air Force Base**  
**Spokane, Washington**

**Site Inspection of**  
**Aqueous Film Forming Foam (AFFF)**  
**Release Areas**  
**Environmental Programs Worldwide**  
**Installation-Specific Work Plan**



Path: K:\AFCEETO 004 PFCa\Fairchild\Figure 3-6 - Proposed Sampling Locations.mxd



**FIGURE 3**  
**Proposed Sampling Locations**  
**FT004 (FT01) and Calibration Area**  
**AFFF Release Areas 1 and 2**  
**Fairchild Air Force Base**  
**Spokane, Washington**

Site Inspection of  
Aqueous Film Forming Foam (AFFF)  
Release Areas  
Environmental Programs Worldwide  
Installation-Specific Work Plan

**Air Force Civil Engineer Center**



2261 Hughes Avenue  
Building 171, Suite 155  
JBSA Lackland, Texas 78236

**Symbol Key**

- |  |   |  |               |
|--|---|--|---------------|
|  | Existing Monitoring Well (to be sampled)                  |  | Fences        |
|  | Proposed Sediment Sample (Sed. Only)                      |  | Railroad      |
|  | Proposed Soil Boring                                      |  | Wall          |
|  | Proposed Temporary Well / Groundwater Grab Sample         |  | Building      |
|  | Monitoring Well   |  | Security Area |
|  | Storm Drain Inlet   |  |               |
|  | Storm Line  |  |               |
|  | Storm Line (abandoned)                                    |  |               |
|  | Storm Open Drainage                                       |  |               |
|  | Storm Culvert   |  |               |
|  | Approximate Uppermost, Shallow Groundwater Flow Direction |  |               |
|  | Potential AFFF Release Area                               |  |               |
|  | Fairchild AFB Installation Boundary                       |  |               |
|  | Limits of Historical Excavation                           |  |               |

\* ONLY WELL LOCATIONS WITHIN THE NEAR VICINITY OF FTA'S LABELED WITH WELL ID



Project: 775303101

Date: 12/21/2016

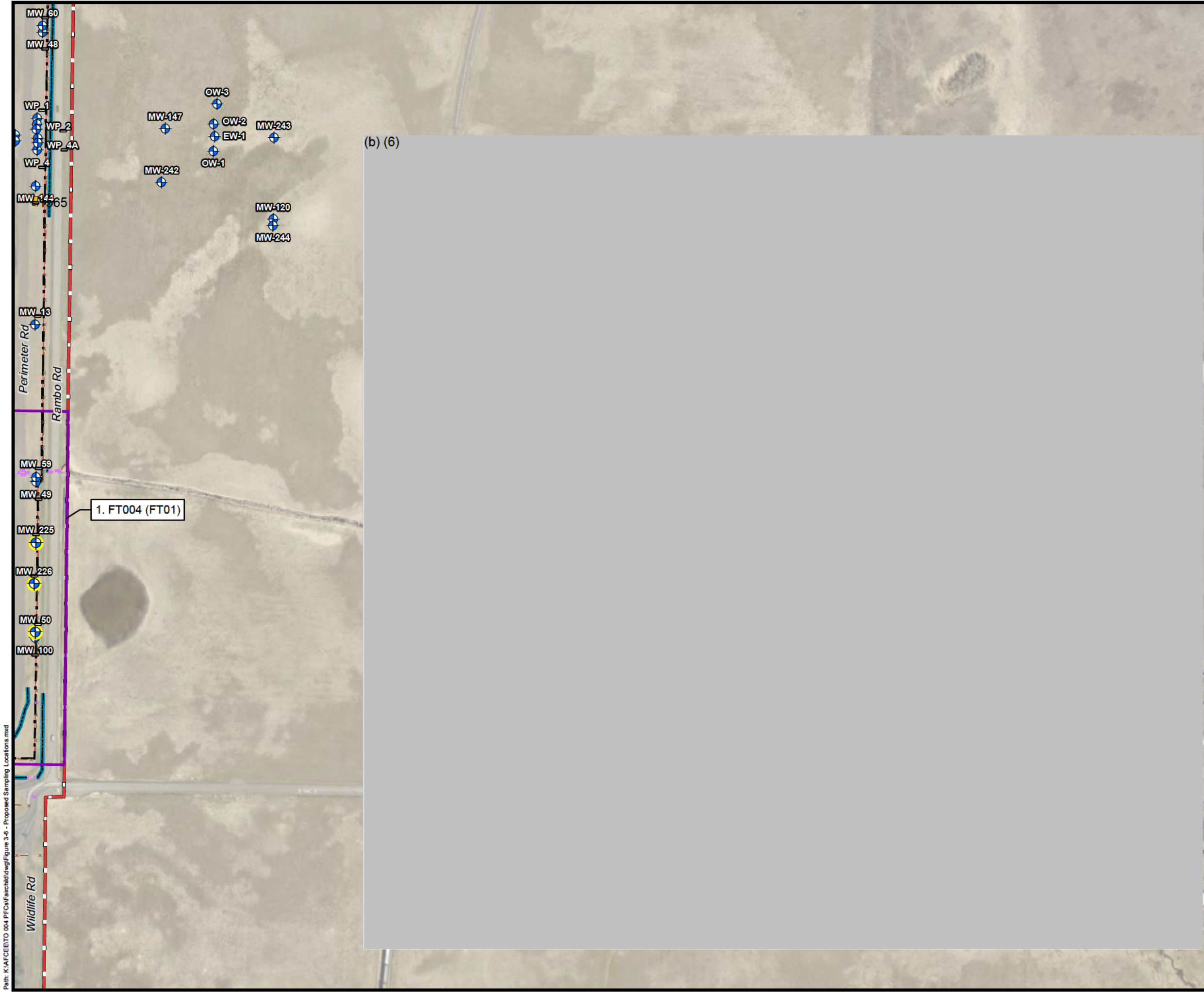
By:SD

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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map features, scale and/or other information.

0 150 300 600  
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**FIGURE 4**  
**Proposed Sampling Locations**  
**FT004 (FT01) and Downgradient Off-Site Wells**  
**AFFF Release Area 1**  
**Fairchild Air Force Base**  
**Spokane, Washington**





















Site Inspection of  
Aqueous Film Forming Foam (AFFF)  
Release Areas  
Environmental Programs Worldwide  
Installation-Specific Work Plan

**Air Force Civil Engineer Center**




2261 Hughes Avenue  
Building 171, Suite 155  
JBSA Lackland, Texas 78236

**Symbol Key**

	Existing Monitoring Well (to be sampled)		Fences
	Proposed Sediment Sample (Sed. Only)		Railroad
	Proposed Soil Boring		Wall
	Proposed Temporary Well / Groundwater Grab Sample		Building
	Monitoring Well		Security Area
	Private Well		
	Storm Drain Inlet		
	Storm Line		
	Storm Line (abandoned)		
	Storm Open Drainage		
	Storm Culvert		
	Approximate Uppermost, Shallow Groundwater Flow Direction		
	Potential AFFF Release Area		
	Fairchild AFB Installation Boundary		
	Limits of Historical Excavation		

\* ONLY WELL LOCATIONS WITHIN THE NEAR VICINITY  
OF FTA's LABELED WITH WELL ID



Project: 775303101

Date: 12/21/2016	By:SD
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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye,  
Earthstar Geographics, CNES/Airbus DS, USDA, USGS,  
AeroGRID, IGN, and the GIS User Community

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DO NOT USE to determine, certify, or verify  
map features, scale and/or other information.

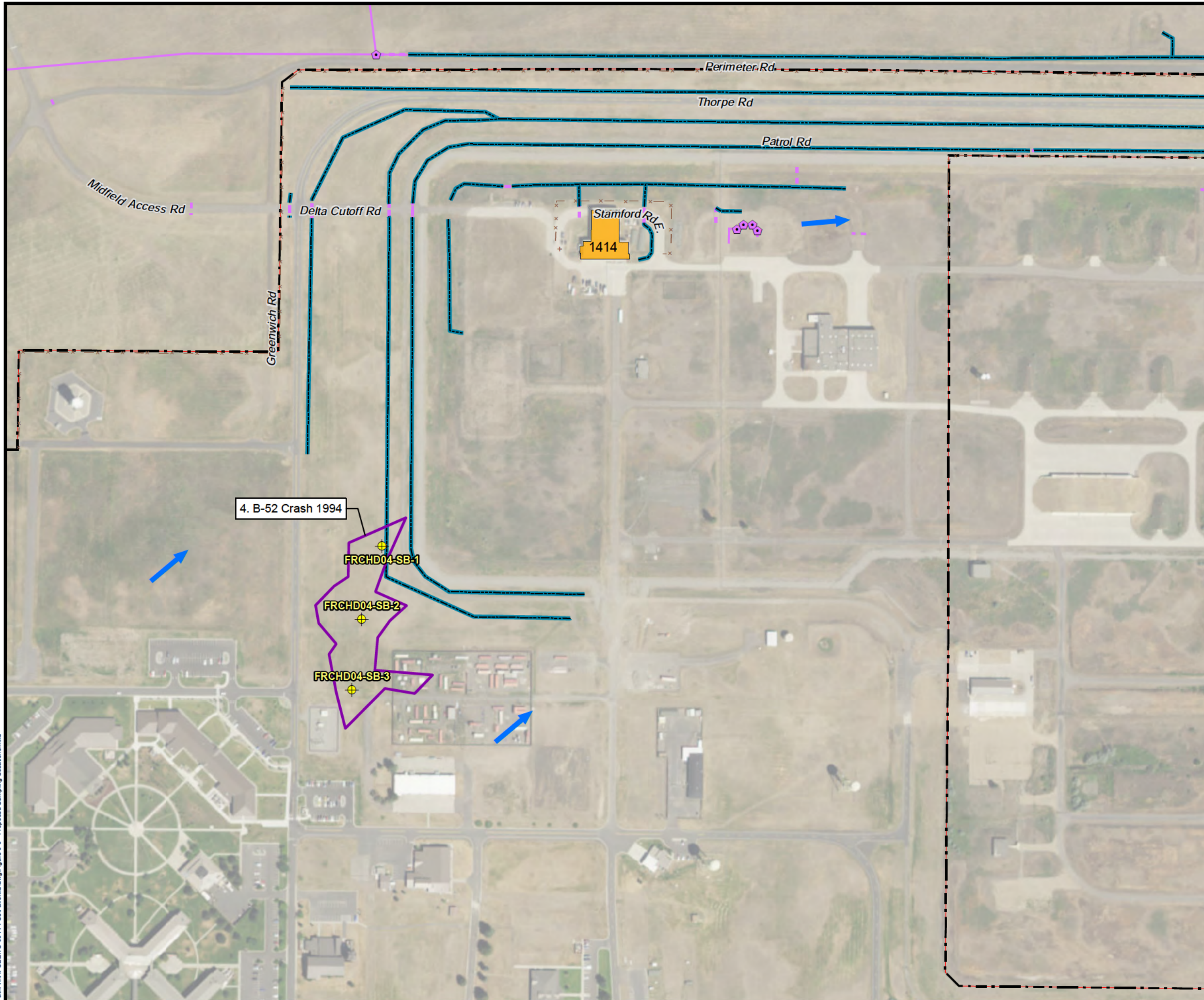
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Path: K:\AFCEETO 004 PFCa\Fairchild\Figure 3-6 - Proposed Sampling Locations.mxd



**FIGURE 6**  
**Proposed Sampling Locations**  
**B-52 Crash Location 1994**  
**AFFF Release Area 4**  
**Fairchild Air Force Base**  
**Spokane, Washington**

Site Inspection of  
Aqueous Film Forming Foam (AFFF)  
Release Areas  
Environmental Programs Worldwide  
Installation-Specific Work Plan

**Air Force Civil Engineer Center**



2261 Hughes Avenue  
Building 171, Suite 155  
JBSA Lackland, Texas 78236

**Symbol Key**

- |  |   |  |               |
|--|---|--|---------------|
|  | Existing Monitoring Well (to be sampled)                  |  | Fences        |
|  | Proposed Sediment Sample (Sed. Only)                      |  | Railroad      |
|  | Proposed Soil Boring                                      |  | Wall          |
|  | Proposed Temporary Well / Groundwater Grab Sample         |  | Building      |
|  | Monitoring Well   |  | Security Area |
|  | Storm Drain Inlet   |  |               |
|  | Storm Line  |  |               |
|  | Storm Line (abandoned)                                    |  |               |
|  | Storm Open Drainage                                       |  |               |
|  | Storm Culvert   |  |               |
|  | Approximate Uppermost, Shallow Groundwater Flow Direction |  |               |
|  | Potential AFFF Release Area                               |  |               |
|  | Fairchild AFB Installation Boundary                       |  |               |
|  | Limits of Historical Excavation                           |  |               |

\* ONLY WELL LOCATIONS WITHIN THE NEAR VICINITY  
OF FTA's LABELED WITH WELL ID



Project: 775303101

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## **APPENDIX A**

### **Installation-Specific Health and Safety Plan**

*The Installation-Specific HSP provided in this appendix supplement the General HSP included as Appendix A to the General QPP. Refer to the HSP and QPP for all job hazard analyses, site control requirements, personal protective equipment needs, safety mitigation measures, and standard operating procedures.*





Site: Fairchild AFB, Spokane, Washington

Prepared by: Joe Fassio

Date: 12/14/2016

Reviewed by: Bethany Flynn

Date: 12/14/2016

#### Dates of Required Training and Medical Surveillance:

Job duties	Field Team Lead/HSO	Field Team	Technical Lead
Name	Joe Fassio	Gabi Ferreira	Teresa Wilson
First Aid	5/22/2015	8/28/2016	8/28/2016
CPR	5/22/2015	8/28/2016	8/28/2016
Hazard Communication	7/12/1990	--	1/4/2012
HAZWOPER	2/2/2016	9/8/2016	9/13/2016

At least one worker must be trained in First Aid/CPR and should receive bloodborne pathogen training.  
Required for Field Lead and Site Health and Safety Officer.

**Notes:**

CPR – cardiopulmonary resuscitation

HAZWOPER – hazardous waste operations and emergency response

HSO – health and safety officer

NA – not available

#### Known or Suspected Contaminants (include permissible exposure limits [PELs]/threshold limit values [TLVs]):

Contaminants of Concern (COC) (Attach Fact Sheets*)	Maximum Concentrations		PEL/TLV
	Soil (mg/kg)	Water/Groundwater (µg/L)	
Perfluorinated Compounds	1.02 (PFOS)	10.8 (PFOA)	N/A
Benzene	0.66	6.7	1 ppm
Toluene	0.64	0.26 (estimated)	200 ppm
Ethylbenzene	0.86	0.77 (estimated)	100 ppm
Xylenes	6.3	3.2	100 ppm
cis-1,2-Dichloroethene	0.0078	1.4	100 ppm
Trichloroethene	0.001	<1.0	100 ppm
Vinyl Chloride	0.002	4.2 (estimated)	1 ppm

**Note:**

µg/L – micrograms per liter

mg/kg – milligrams per kilogram

N/A = not applicable

PEL – permissible exposure limit

PFOA – perfluorooctanoic acid

PFOS – perfluorooctanesulfonic acid

ppm – parts per million

TLV – threshold limit value

# 1 EMERGENCY CONTACTS

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
Fire Department:	911		
Hospital: Deaconess Hospital 800 West 5th Avenue, Spokane, WA 99204	509-458-5800		
Police/Ambulance/Fire:	911		
Client Contact: Marc Connally	(O): 509-247-8148	(C): (b) (6)	
Client Contact (Alternate): Ed Zuelke	(O): 509-247-8152	(C):	
Regional Lead: Bethany Flynn	(O): 707-793-3834	(C):	
Site Health And Safety Officer: Joe Fassio	(O): 503-639-3400	(C):	
Group Health Safety and Environment (HSE) Manager: Chad Barnes	(O): 602-733-6000	(C):	

2



## 1 EMERGENCY PROCEDURES

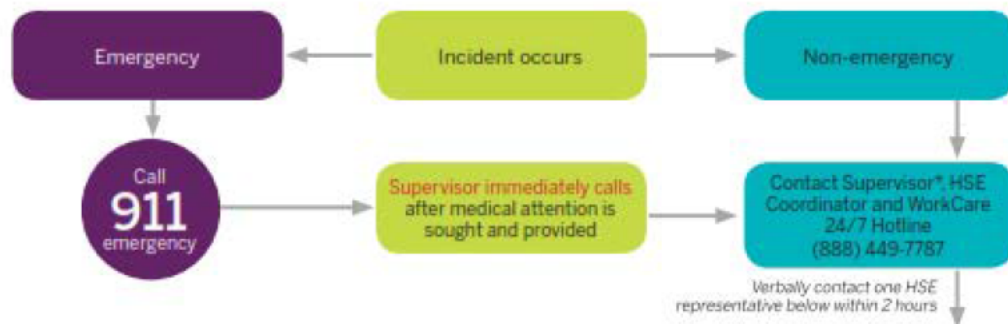
- The health and safety officer (HSO) or alternate should be immediately notified via the on-site communication system. The HSO assumes control of the emergency response.
- The HSO notifies the project manager and client contact of the emergency. The HSO shall then contact the group health, safety, and environment (HSE) manager who will then contact the corporate HSE manager.
- If applicable, the HSO shall notify off-site emergency responders (e.g. fire department, hospital, police department, etc.) and shall inform the response team as to the nature and location of the emergency on-site.
- If applicable, the HSO evacuates the site. Site workers should move to the predetermined evacuation point (See Site Map).
- For small fires, flames should be extinguished using the fire extinguisher. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE, including self-contained breathing apparatus (SCBA) if available, should be donned. If appropriate PPE is unavailable, site workers should evacuate and call in emergency personnel.
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash and wash affected area. Site worker should shower as soon as possible after incident.
- If a worker is injured, first aid shall be administered by certified first aid provider. See Amec Foster Wheeler Triage Program below
- If the emergency involves toxic gases, workers will back off and reassess. Prior to re-entering the work zone, the area must be determined to be safe. Entry will be using Level B PPE and utilize appropriate monitoring equipment to verify that the site is safe.
- Within 24 hours after any emergency response, the Incident Analysis Report (and Vehicle Incident Report if vehicle incident) shall be completed and returned to the group HSE manager, who will forward a copy to the corporate HSE manager. Injuries requiring medical treatment beyond first aid (as well as work-related vehicle incidents) will require the employee to submit a post incident drug and alcohol test.

### **Amec Foster Wheeler WorkCare Program**

- If the emergency involves an injury to an Amec Foster Wheeler employee, the local HSE coordinator, field lead are to implement the Amec Foster Wheeler WorkCare program. Employees whose injuries are true emergencies and who need immediate medical attention will initially bypass this program and are to be immediately sent/taken to the hospital identified in the routes to emergency medical facilities section below.
- For non-emergency injuries, the supervisor field lead and the injured employee will contact the Amec Foster Wheeler WorkCare 24/7 Hotline at 1-888-449-7787 and speak to a nurse case manager. The nurse case manager will perform the intake process and ask for information including the following:
  - Explain the process to the caller
  - Determine the nature of the concern
  - Provide appropriate medical advice to the caller
  - Determine the appropriate path forward with the caller
  - Maintain appropriate medical confidentiality
  - Help caller to execute path forward – including a referral to the appropriate local medical facility
  - Send an email notification to the corporate safety contact
- From this, a collaborative decision will be made between the nurse case manager and the injured employee on the most appropriate place for treatment; either the hospital, the clinic, or onsite first aid
- If the employee is to be sent to a clinic or hospital, the nurse will call ahead to explain the situation, the need for testing, and advises options to avoid OSHA recordable & considerations for return to work & transitional/modified duty. The nurse will also arrange for drug and alcohol testing to be conducted at the hospital/clinic. If the employee is to be treated on site (First Aid), the nurse will advise the employee to call if injury gets worse. Attached is a flow diagram that describes this procedure.

# Incident flow chart

Call immediately



## E&I Corporate HSE department contact list

Name/email	Office location	Contact information
Bruce Voss bruce.voss@amecfw.com	Cathedral City, CA	760.202.3737 (office) (b) (6) (cell)
Chad Barnes chad.barnes@amecfw.com	Phoenix, AZ	602.733.6000 (office) (b) (6) (cell)
Cindy Sundquist cynthia.sundquist@amecfw.com	Portland, ME	207.828.3309 (office) (b) (6) (cell) (home)
Gabe Sandholm gabe.sandholm@amecfw.com	Minneapolis, MN	612.252.3785 (office) (b) (6) (cell)
John Mazur john.mazur@amecfw.com	Wilmington, NC	910.444.2978 (office) (b) (6) (cell) (home)
Lori Dowling lori.dowling@amecfw.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@amecfw.com	Thorold, ON	905.687.6616 (office) (b) (6) (cell)
Tim Kihn tim.kihn@amecfw.com	Edmonton, AB	780.944.6363 (office) (b) (6) (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivenky@amecfw.com	Plymouth Meeting, PA	610.877.6144 (office) (b) (6) (cell) (home)
Kirby Lastinger kirby.lastinger@amecfw.com	Lakeland, FL	836-667-2345 x207 (office) (b) (6) (cell)

High potential near misses, subcontractor incidents, regulatory inspections, spills, and property damage should be reported within 60 minutes to one of the above HSE Representatives.

### \*Supervisor Responsible For:

- D&A Testing: Coordination as per client and AmecFW requirements, Local/Client Notifications, and Completing Initial IAR within 24 hours and forwarding to Corporate HSE.

Rev: Oct 2015



1 **FIELD TEAM REVIEW:** I acknowledge that I understand the requirements of this HSP, and agree to abide  
2 by the procedures and limitations specified herein. I also acknowledge that I have been given an  
3 opportunity to have my questions regarding the HSP and its requirements answered prior to performing  
4 field activities. Health and safety training and medical surveillance requirements applicable to my  
5 fieldactivities at this site are current and will not expire during on-site activities.

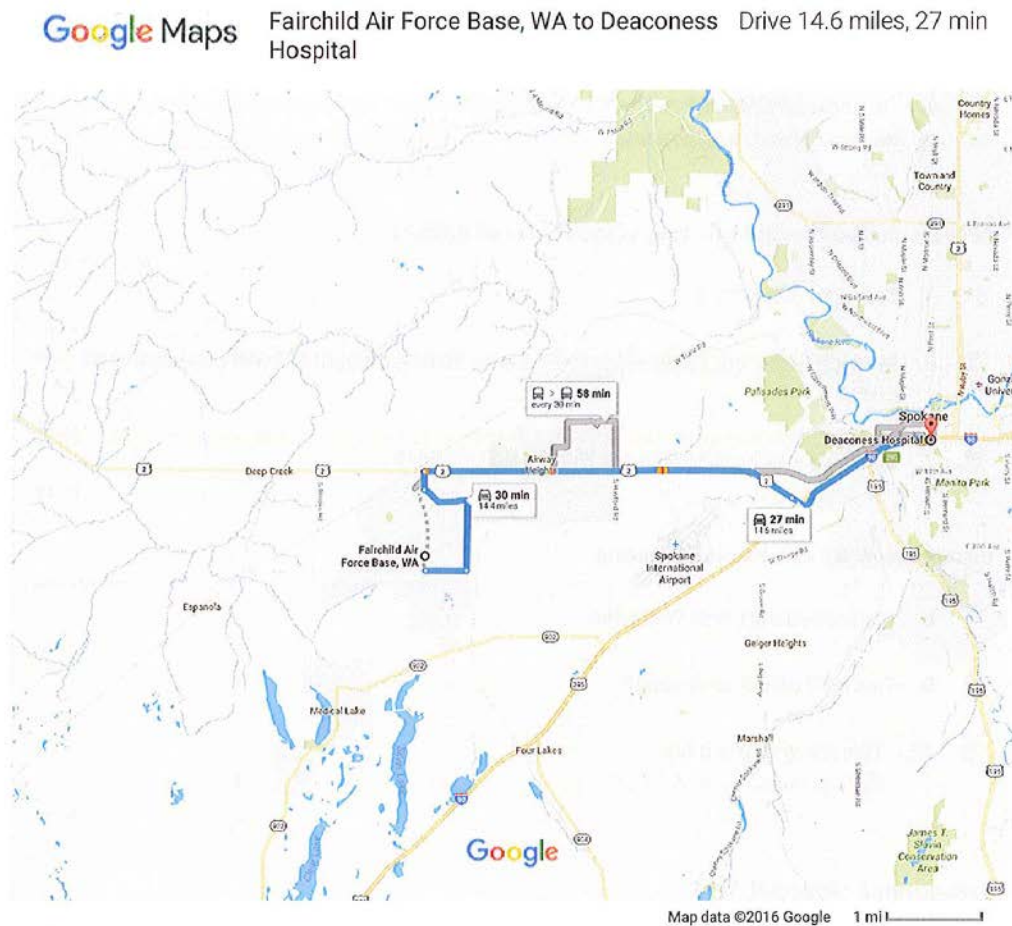
6

Name:	_____	Date:	_____
Name:	_____	Date:	_____
Name:	_____	Date:	_____
Name:	_____	Date:	_____
Name:	_____	Date:	_____

## ROUTES TO EMERGENCY MEDICAL FACILITIES

### HOSPITAL (for immediate emergency treatment):

Facility Name: Deaconess Hospital  
Address: 800 West 5<sup>th</sup> Avenue  
Spokane, WA 99204  
Telephone Number: 509-458-5800



#### Fairchild Air Force Base, WA

Take S Rambo Rd and Eaker Rd to US-2 E

- ↑ 1. Head east on Thorpe Rd toward S Rambo Rd  
⚠ Restricted usage road
- ↑ 2. Thorpe Rd turns slightly left and becomes S Rambo Rd  
⚠ Restricted usage road

11 min (3.6 mi)

0.8 mi

1.4 mi

CONTINUED NEXT PAGE

3. Turn left onto Eaker Rd  
⚠️ Restricted usage road  
1.0 mi

4. Turn right onto Mitchell St  
⚠️ Partial restricted usage road  
0.4 mi

Continue on US-2 E to Spokane. Take exit 280 from I-90 E/US-2 E  
14 min (10.4 mi)

5. Turn right onto US-2 E  
7.7 mi

6. Keep left at the fork, follow signs for Interstate 90 E/Spokane/U.S. 2 and merge onto I-90 E/US-2 E  
2.5 mi

7. Use the right 2 lanes to take exit 280 toward Lincoln St  
0.3 mi

Continue on W 4th Ave. Drive to W 5th Ave  
2 min (0.6 mi)

8. Continue straight onto W 4th Ave  
0.2 mi

9. Turn right onto S Jefferson Dr  
351 ft

10. Turn left onto W 5th Ave  
📍 Destination will be on the left  
0.3 mi

**Deaconess Hospital**  
800 West 5th Avenue, Spokane, WA 99204

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.